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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-194360
(43)Date of publication of application : 21.07.1999

(51)Int.Cl. G02F 1/136

(21)Application number : 10-084661
(22)Date of filing : 30.03.1998

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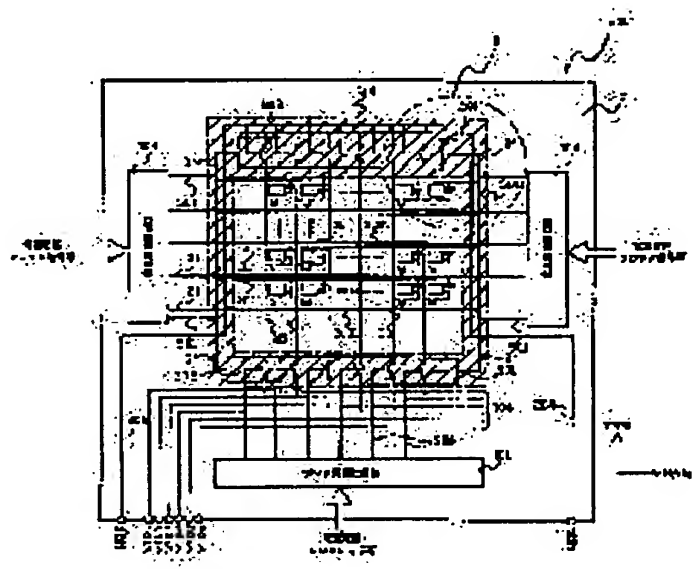
(30)Priority
Priority number : 09301250 Priority date : 31.10.1997 Priority country : JP

(54) LIQUID CRYSTAL DEVICE, ELECTRONIC EQUIPMENT, AND PROJECTION DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain image display of high quality by superior switching by improving light shielding against return light, etc., from below TFTs(thin film transistor) of a precharge circuit, a sampling circuit, etc., in an active matrix drive liquid crystal device.
SOLUTION: The liquid crystal device 200 is equipped with a liquid crystal layer sandwiched between a couple of substrates, pixel electrodes 11 which are provided in matrix on the substrate, and TFTs 30 which perform switching control over them. A light shield layer is provided below those TFTs 30 and the TFTs 202 to 302 of the precharge circuit 201 and sampling circuit 301.



LEGAL STATUS

[Date of request for examination]	07.11.2002
[Date of sending the examiner's decision of rejection]	28.06.2005
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2005-14281
[Date of requesting appeal against examiner's	26.07.2005

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CLAIMS

[Claim(s)]
[Claim 1] It comes to pinch liquid crystal between the 1st and 2nd substrates of a pair. On said 1st substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st switching elements connected to two or more of said scanning lines and data lines, The sampling circuit which has two or more pixel electrodes connected to said two or more 1st switching elements, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among the precharge circuits which precede the precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In the location which counters one [at least] component of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively Liquid crystal equipment characterized by having further the protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] component.
[Claim 2] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment according to claim 1 characterized by including the semi-conductor layer which constitutes this thin film transistor that consisted of a thin film transistor and was formed through the insulator layer on said protection-from-light layer.
[Claim 3] It is liquid crystal equipment according to claim 1 or 2 which at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD (Lightly Doped Drain) structure, and is characterized by preparing said protection-from-light layer in the location which counters the channel field and LDD field of this thin film transistor at least.
[Claim 4] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-3 characterized by crossing to the whole region and being formed from the same ingredient by the same film formation process.
[Claim 5] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-4 characterized by connecting with the constant source of potential.
[Claim 6] The constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to touch-down potential.
[Claim 7] It is liquid crystal equipment according to claim 5 characterized by having further the counterelectrode prepared in the side which meets said liquid crystal of said 2nd substrate, and the constant potential of said constant source of potential being equal to the potential of said counterelectrode.
[Claim 8] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment given in any 1 term of claims 1-7 characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.
[Claim 9] The seal member which sticks said 1st and 2nd substrates in the perimeter of the screen-display field specified with said two or more pixel electrodes on a flat surface parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of the protection-from-light nature formed along with the profile of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said flat surface. One [said / at least] circuit is liquid crystal equipment given in any 1 term of claims 1-8 characterized by being prepared in the location which counters said circumference abandonment.
[Claim 10] It is liquid crystal equipment given in any 1 term of claims 1-9 to which said precharge circuit is prepared, and said two or more data lines are characterized by supplying said precharge signal from the other side while said picture signal is supplied from the one side of said data line.

[Claim 11] It is liquid crystal equipment given in any 1 term of claims 1-10 characterized by establishing further the inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal equipment concerned in said 1st substrate, and preparing said protection-from-light layer further between said 1st substrate and said 4th switching element in the location which counters said 4th switching element.
[Claim 12] It is liquid-crystal equipment characterized by replacing with one [said / at least] circuit, establishing the circumference circuit containing the 5th switching element for the electrical-potential-difference maintenance for operating the liquid crystal equipment concerned in said 1st substrate in liquid crystal equipment according to claim 1, and preparing said protection-from-light layer between said 1st substrate and said 5th switching element in the location which counters said 5th switching element.
[Claim 13] Electronic equipment characterized by equipping claims 1-12 with the liquid crystal equipment of a publication.
[Claim 14] In the projection mold display which has the light source, the liquid crystal light valve which incidence of the light by which outgoing radiation is carried out from this light source is carried out, and performs the modulation corresponding to image information, and the delivery system which projects the light modulated with said liquid crystal light valve The liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at the 1st substrate [with which said liquid crystal light valve has been arranged at the incidence side of light], and outgoing radiation side, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. The projection mold display characterized by the thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment between said 2nd substrate and said 1st thin film transistor.
[Claim 15] The light source and a color separation means to separate into the colored light bundle of at least 2 colors the flux of light by which outgoing radiation is carried out from this light source, The liquid crystal light valve which performs the modulation corresponding to image information to the flux of light of each color separated by said color separation means, In the projection mold display which has a synthetic means to compound the light modulated with said liquid crystal light valve, and the delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means The liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at the 1st substrate [with which said liquid crystal light valve has been arranged at the incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. It is the projection mold display characterized by the thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means between said 2nd substrate and said 1st thin film transistor.
[Claim 16] The projection mold display according to claim 15 characterized by said synthetic means consisting of a prism unit.
[Claim 17] A projection mold display given in any 1 term of claim 14 characterized by having further a ventilation means for sending a wind between said liquid crystal equipment and said 2nd polarization means thru/or claim 16.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention belongs to the technical field of the electronic equipment using the liquid crystal equipment of a active-matrix drive method and this by thin film transistor (TFT is called suitably below) drive, and belongs to the technical field of the electronic equipment using the liquid crystal equipment of a format and this which are especially used for a liquid crystal projector etc. and which prepared the protection-from-light layer in the TFT bottom.
[0002]
[Description of the Prior Art] When this kind of liquid crystal equipment is conventionally used for a liquid crystal projector etc. as a light valve, generally on both sides of a liquid crystal layer, incidence of the incident light is carried out to a TFT array substrate from the opposite substrate side by which opposite arrangement is carried out. Here, if incident light carries out incidence to the field for channel formation which consisted of the amorphous silicon film and polish recon film of TFT, in this field, a photocurrent will occur according to the photo-electric-conversion effectiveness, and the transistor characteristics of TFT will deteriorate. For this reason, it is common to an opposite substrate that a protection-from-light layer is formed in each location which counters TFT, respectively from metallic materials, resin blacks, etc., such as Cr (chromium).
[0003] furthermore , especially in this kind of liquid crystal equipment , to use the amorphous silicon or poly-Si TFT of the forward stagger mold which take top gate structure (namely , structure where the gate electrode be prepared on the TFT array substrate at the channel bottom) , or a coplanar mold , a part of incident light need to prevent carry out incidence to the channel of TFT from a TFT array substrate side as a return light by the incident light study system in a liquid crystal projector . Similarly, a part of reflected light from the front face of the TFT array substrate at the time of incident light passing and incident light which runs through an incident light study system after carrying out outgoing radiation from other liquid crystal equipments in the case of using it combining two or more liquid crystal equipments for colors further need to protect carrying out incidence to the channel field of TFT from a TFT array substrate side as a return light. for this reason, the location (namely, under TFT) which counters in JP,9-127497,A, JP,3-52611,B, JP,3-125123,A, and JP,8-171101,A at TFT on the TFT array substrate which consists of a quartz substrate etc. -- for example, the liquid crystal equipment which formed the protection-from-light layer from the opaque refractory metal is proposed.
[0004] On the other hand, in this kind of liquid crystal equipment, various kinds of circumference circuits which use TFT(s), such as a scanning-line drive circuit, a data-line drive circuit, a precharge circuit, a sampling circuit, and an inspection circuit, as a component may be prepared on such a TFT array substrate.
[0005] Among these circumference circuits, a precharge circuit is the timing preceded with the picture signal supplied from a data-line drive circuit to the data line for the purpose of reduction of improvement in a contrast ratio, the stability of the potential level of the data line, and the Rhine unevenness on a display screen etc., and is a circuit which mitigates the load at the time of writing a picture signal in the data line by supplying a precharge signal (image auxiliary signal). In case a picture signal will be written in the data line in the so-called 1H reversal drive method which is reversed a predetermined period and drives the electrical-potential-difference polarity of the data line usually performed if the precharge signal is beforehand written in the data line in order to carry out the alternating current drive especially of the liquid crystal, required quantity of electricity can be lessened notably. For example, an example of such a precharge circuit is indicated by JP,7-295520,A.
[0006] A sampling circuit is a circuit which samples a picture signal, in order to supply the picture signal of

high frequency to each data line stably to predetermined timing synchronizing with a scan signal. Moreover, an inspection circuit is a circuit for inspecting the quality of the liquid crystal equipment at the manufacture middle or the time of shipment, a defect, etc. It is also possible to prepare various kinds of circumference circuits using TFT etc. on a TFT array substrate also out of it from viewpoints, such as improvement in the image quality in a liquid crystal display, reduction of power consumption, and reduction of cost.
[0007] By the way, if direct current voltage is impressed to the liquid crystal by which the closure was carried out into this kind of liquid crystal equipment, causing degradation of liquid crystal is known. For this reason, generally, carrying out the direct-current drive of the liquid crystal is not performed, but it is made to carry out the alternating current drive of the liquid crystal by carrying out electrical-potential-difference inversion of the picture signal over each pixel the predetermined periods for every field. However, if the above-mentioned circumference circuit is established in the substrate part which faces liquid crystal, the direct-current-voltage component in a circumference circuit will be impressed to liquid crystal to some extent, and degradation of liquid crystal will be caused like the case where above-mentioned a direct-current drive is carried out. Therefore, it is not common to establish these circumference circuits in the substrate part which faces liquid crystal. Moreover, it is not common to establish a circumference circuit in the substrate part which faces liquid crystal from a viewpoint which reduces a display area relatively. For this reason, these circumference circuits are established in the circumference part of the TFT array substrate dedicated to the interior of the case of protection-from-light nature which consists of plastics etc. Therefore, to TFT which constitutes these circumference circuits, like TFT which drives the above-mentioned pixel electrode, the protection-from-light layer to incident light is not prepared in an opposite substrate side, or the protection-from-light layer to return light is not prepared in a TFT array substrate side.
[0008]
[Problem(s) to be Solved by the Invention] In liquid crystal equipment, if the size of the liquid crystal module which added the circumference circuit is the same, the screen-display field specified with two or more pixel electrodes arranged in the shape of a matrix, i.e., the field as which an image is actually displayed by change of the orientation condition of liquid crystal on liquid crystal equipment, has the general request of being so good that it being large.
[0009] however -- the configuration which establishes the above-mentioned circumference circuit in the circumference part of the substrate dedicated to the case of protection-from-light nature -- inevitable -- the width of face of this case part -- increasing -- the above -- it cannot reply to a general request. On the contrary, when these circumference circuits are established in a narrow long and slender circumference part by force, there is a trouble that it becomes difficult to design these circumference circuit so that a specific specification may be met.
[0010] Moreover, in having established the circumference circuit in the substrate part which faces the liquid crystal in a screen-display field, incident light will carry out incidence to TFT which constitutes a circumference circuit from an opposite substrate side, or return light will carry out incidence from a TFT array substrate side. For this reason, there is a trouble that a photocurrent will occur and the transistor characteristics of TFT will deteriorate. In addition, in having established the circumference circuit in the substrate part which faces the liquid crystal in a screen-display field, while causing reduction in a display area, there is also a trouble that the special configuration for preventing impressing direct current voltage to liquid crystal from a circumference circuit is needed.
[0011] The protection-from-light engine performance of this invention to light, such as return light from the switching element bottom, such as TFT which it is made in view of the trouble mentioned above, and circumference circuits, such as a precharge circuit, a sampling circuit, and an inspection circuit, have, is high, and let it be a technical problem to offer the electronic equipment equipped with the liquid crystal equipment in which image display is possible and the liquid crystal equipment concerned of high quality with the outstanding switching characteristic.
[0012]
[Means for Solving the Problem] In order that liquid crystal equipment according to claim 1 may solve the above-mentioned technical problem, it comes to pinch liquid crystal between the 1st and 2nd substrates of a pair. On said 1st substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st switching elements connected to two or more of said scanning lines and data lines, The sampling circuit which has two or more pixel electrodes connected to said two or more 1st switching elements, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among the precharge circuits which precede the precharge signal of a predetermined voltage level with said picture

signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In the location which counters one [at least] component of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively It is characterized by having further the protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] component.

[0013] According to liquid crystal equipment according to claim 1, a sampling circuit samples a picture signal by two or more 2nd switching elements which consist of TFT etc., and supplies it to two or more data lines. A precharge circuit precedes the precharge signal of a predetermined voltage level with a picture signal by two or more 3rd switching elements which consist of TFT etc. at two or more data lines, and supplies it, respectively. One [at least] circuit is established in the 1st substrate among these sampling circuits and precharge circuits. Here, the protection-from-light layer is prepared in the location which counters one [at least] component of the 2nd and 3rd switching elements which one circuit has, respectively even if this ** cannot be found in the 1st switching element list between the 1st substrate, the 1st switching element, and one [this] component, respectively. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effectiveness in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, and a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about a sampling circuit or a precharge circuit is given, the need of arranging these circuits into the circumference part of the 1st substrate into which it was put by the case of protection-from-light nature like before is lost. For example, these circuits can also be arranged to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.

[0014] In order that liquid crystal equipment according to claim 2 may solve the above-mentioned technical problem, in liquid crystal equipment according to claim 1, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor, and it is characterized by including the semi-conductor layer which constitutes this thin film transistor formed through the insulator layer on said protection-from-light layer.

[0015] According to liquid crystal equipment according to claim 2, among the 1st, 2nd, and 3rd switching elements at least one Although the semi-conductor layer which constitutes the thin film transistor (TFT) formed through the insulator layer on the protection-from-light layer is included, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this semi-conductor layer, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this semi-conductor layer, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[0016] In order that liquid crystal equipment according to claim 3 may solve the above-mentioned technical problem, in liquid crystal equipment according to claim 1 or 2, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD structure, and it is characterized by preparing said protection-from-light layer in the location which counters the channel field and LDD field of this thin film transistor at least.

[0017] According to liquid crystal equipment according to claim 3, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of LDD structure, but Since the protection-from-light layer is prepared in the location which counters this channel field of TFT, and a LDD field at least Even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this channel field and a LDD field, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these. For this reason, in this channel field and a LDD field, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[0018] In order that liquid crystal equipment according to claim 4 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-3, it is characterized by crossing said protection-from-light layer to the whole region, and forming it from the same ingredient by the same film formation process.

[0019] According to liquid crystal equipment according to claim 4, although the protection-from-light layer is prepared to various kinds of switching elements, it goes across a protection-from-light layer throughout

the, and it is formed from the same ingredient by the same film formation process. That is, it becomes possible to form the protection-from-light layer to various kinds of switching elements according to the same process in the production process of the liquid crystal equipment concerned in this case.
[0020] In order that liquid crystal equipment according to claim 5 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-4, said protection-from-light layer is characterized by connecting with the constant source of potential.
[0021] According to liquid crystal equipment according to claim 5, since the protection-from-light layer is connected to the constant source of potential, let a protection-from-light layer be constant potential. Therefore, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[0022] In order that liquid crystal equipment according to claim 6 may solve the above-mentioned technical problem, in liquid crystal equipment according to claim 5, constant potential of said constant source of potential is characterized by being equal to touch-down potential.
[0023] According to liquid crystal equipment according to claim 6, since a protection-from-light layer is made into touch-down potential, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[0024] In order that liquid crystal equipment according to claim 7 may solve the above-mentioned technical problem, it has further the counterelectrode prepared in the side which meets said liquid crystal of said 2nd substrate in liquid crystal equipment according to claim 5, and constant potential of said constant source of potential is characterized by being equal to the potential of said counterelectrode.
[0025] According to liquid crystal equipment according to claim 7, since a protection-from-light layer is made into the potential of a counterelectrode, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[0026] In order that liquid crystal equipment according to claim 8 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-7, at least one of said 1st, 2nd, and 3rd switching elements is characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.
[0027] According to liquid crystal equipment according to claim 8, it is at least one of the 1st, 2nd, and 3rd switching elements, Although it consists of TFT of any one mold in an N channel mold, a P channel mold, and a complementary type Since the protection-from-light layer is prepared in this location that counters TFT at least, even if return light etc. carries out incidence from the 1st substrate side, before [this] carrying out incidence to TFT, this return light etc. will be shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this TFT, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.
[0028] In liquid crystal equipment given in any 1 term of claims 1-8 in order that liquid crystal equipment according to claim 9 may solve the above-mentioned technical problem The seal member which sticks said 1st and 2nd substrates in the perimeter of the screen-display field specified with said two or more pixel electrodes on a flat surface parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of the protection-from-light nature formed along with the profile of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said flat surface, and one [said / at least] circuit is characterized by being prepared in the location which counters said circumference abandonment.
[0029] According to liquid crystal equipment according to claim 9, circumference abandonment of protection-from-light nature is formed along with the profile of a screen-display field at the 2nd substrate between the seal members and screen-display fields which surround liquid crystal. Here, among a sampling circuit and a precharge circuit, since one [at least] circuit is established in the location which counters circumference abandonment, if it is called circumference abandonment and says, a deployment of dead space can be aimed at. In this case, before carrying out incidence to the switching element which these sampling circuits and precharge circuits have even if incident light etc. carries out incidence from the 2nd substrate side since especially circumference abandonment is protection-from-light nature, this incident light etc. is shaded by circumference abandonment. Therefore, it originates in incident light etc. and there is no un-arranging [for which a photocurrent occurs according to the photo-electric-conversion effectiveness in a

switching element, and a switching characteristic deteriorates]. Thus, if a sampling circuit and a precharge circuit are arranged in the location which counters circumference abandonment, since it is not necessary to give protection from light to the light from the 2nd substrate side, it is very advantageous.
[0030] Said two or more data lines are characterized by supplying said precharge signal from the other side while said precharge circuit is prepared in liquid crystal equipment given in any 1 term of claims 1-9 and said picture signal is supplied from the one side of said data line, in order that liquid crystal equipment according to claim 10 may solve the above-mentioned technical problem.
[0031] According to liquid crystal equipment according to claim 10, a picture signal is supplied from the one side of said data line, and, as for two or more data lines, a precharge signal is supplied from the other side of said data line. Therefore, a precharge circuit can be established in an opposite side across the data-line drive circuit, sampling circuit, etc. and screen-display field for supplying a picture signal.
[0032] In liquid crystal equipment given in any 1 term of claims 1-10 in order that liquid crystal equipment according to claim 11 may solve the above-mentioned technical problem The inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal equipment concerned is further established in said 1st substrate. Said protection-from-light layer It is characterized by being further prepared between said 1st substrate and said 4th switching element in the location which counters said 4th switching element.
[0033] According to liquid crystal equipment according to claim 11, the protection-from-light layer is prepared in the location which counters the 4th switching element which an inspection circuit has between the 1st substrate and this 4th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 4th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, in the 4th switching element which consists of TFT etc., for example, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about an inspection circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.
[0034] Liquid crystal equipment according to claim 12 is set to liquid crystal equipment according to claim 1, in order to solve the above-mentioned technical problem. It replaces with one [said / at least] circuit, and the circumference circuit containing the 5th switching element for the electrical-potential-difference maintenance for operating the liquid crystal equipment concerned is established in said 1st substrate. Said protection-from-light layer It is characterized by being prepared between said 1st substrate and said 5th switching element in the location which counters said 5th switching element.
[0035] According to liquid crystal equipment according to claim 12, the protection-from-light layer is prepared in the location which counters the 5th switching element which a circumference circuit has between the 1st substrate and this 5th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 5th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effectiveness in the 5th switching element which consists of TFT etc., for example, a switching characteristic deteriorates, and a maintenance electrical potential difference changes is prevented beforehand. Furthermore, in this way, since protection from light about a circumference circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.
[0036] It is characterized by electronic equipment according to claim 13 equipping claims 1-12 with the liquid crystal equipment of a publication, in order to solve the above-mentioned technical problem.
[0037] According to electronic equipment according to claim 13, electronic equipment is equipped with the liquid crystal equipment of the invention in this application mentioned above, and since various kinds of actuation is performed by the switching element in which the protection-from-light engine performance to return light etc. has the highly excellent switching characteristic, the high-definition image display of it becomes possible.
[0038] The liquid crystal light valve with which incidence of the light to which outgoing radiation of the projection mold display according to claim 14 is carried out from the light source and this light source is carried out, and it performs the modulation corresponding to image information, In the projection mold indicating equipment which has the delivery system which projects the light modulated with said liquid crystal light valve said liquid crystal light valve The liquid crystal equipment with which liquid crystal was

pinched between the 2nd substrate arranged at the 1st substrate [which has been arranged at the incidence side of light], and outgoing radiation side, It consists of the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment.

[0039] According to the projection mold indicating equipment according to claim 14, the leakage current by return light can be prevented by forming a protection-from-light layer between the 2nd substrate and the 1st thin film transistor. Moreover, since the effect on the liquid crystal light valve by return light can be prevented, it is not necessary to stick a polarization means with an antireflection film on liquid crystal equipment like before. therefore -- without it sticks the 2nd polarization means on liquid crystal equipment -- alienation -- since it can form, the temperature rise of a liquid crystal light valve can be prevented.

[0040] A color separation means by which a projection mold display according to claim 15 separates into the colored light bundle of at least 2 colors the flux of light by which outgoing radiation is carried out from the light source and this light source, The liquid crystal light valve which performs the modulation corresponding to image information to the flux of light of each color separated by said color separation means, In the projection mold display which has a synthetic means to compound the light modulated with said liquid crystal light valve, and the delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means The liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at the 1st substrate [with which said liquid crystal light valve has been arranged at the incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means.

[0041] According to the projection mold display according to claim 15, since the 2nd polarization means is stuck on the synthetic means, space is formed between liquid crystal equipment and the 2nd polarization means. Therefore, the temperature rise of liquid crystal equipment can be avoided and malfunction of a liquid crystal light valve can be prevented.

[0042] A projection mold display according to claim 16 is characterized by said synthetic means consisting of a prism unit in a projection mold display according to claim 15.

[0043] According to the projection mold display according to claim 16, said synthetic means consists of a prism unit, and the 2nd polarization means is stuck on the prism unit. The prism unit is effective in order to be able to absorb the heat capacity of the 2nd polarization means in a prism unit since heat capacity is large, and to prevent the temperature rise of a liquid crystal light valve.

[0044] A projection mold display according to claim 17 is characterized by having further a cooling means to send cold blast between said liquid crystal equipment and said 2nd polarization means in a projection mold display according to claim 15 or 16.

[0045] According to the projection mold display according to claim 17, by forming a cooling means, for example in either a synthetic means top or the bottom, and sending cold blast between liquid crystal equipment and a polarization means from a cooling means, the temperature rise of a liquid crystal light valve can be prevented further, and malfunction of a liquid crystal light valve can be prevented.

[0046] Such an operation and other gains of this invention are made clear from the gestalt of the operation explained below.

[0047]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.

[0048] (Configuration of liquid crystal equipment) The configuration of the gestalt of operation of liquid crystal equipment is explained based on drawing 5 from drawing 1 .

[0049] First, the whole liquid crystal equipment configuration is explained with reference to drawing 3 from drawing 1 . Drawing 1 is the block diagram showing the configuration of a various wiring, a circumference circuit, etc. which were prepared on the TFT array substrate in the gestalt of operation of liquid crystal equipment, drawing 2 is the top view which looked at the TFT array substrate from the opposite substrate side with each component formed on it, and drawing 3 is a H-H' sectional view of drawing 2 shown including an opposite substrate.
[0050] Liquid crystal equipment 200 is equipped with the TFT array substrate 1 which consists of a quartz substrate, hard glass, a silicon substrate, etc. in drawing 1 . Two or more pixel electrodes 11 prepared in the shape of a matrix on the TFT array substrate 1, The data line 35 which two or more arrays are carried out in the direction of X, and is extended along the direction of Y, respectively, The scanning line 31 which two or more arrays are carried out in the direction of Y, and is extended along the direction of X, respectively, While intervening between each data line 35 and the pixel electrode 11, respectively, two or more TFT30 as an example of the switching element which controls the switch-on and the non-switch-on between these according to the scan signal supplied through the scanning line 31, respectively, respectively is formed. Moreover, on the TFT array substrate 1, capacity line 31' (the 2nd storage capacitance electrode) which is wiring for the below-mentioned storage capacitance (refer to drawing 6) is formed in parallel with the scanning line 31.
[0051] The precharge circuit 201 which precedes the precharge signal of a predetermined voltage level with a picture signal, and supplies it to further two or more data lines 35 on the TFT array substrate 1, respectively, the sampling circuit 301 which samples a picture signal and is supplied to two or more data lines 35, respectively, the data-line drive circuit 101, and the scanning-line drive circuit 104 are formed.
[0052] The scanning-line drive circuit 104 impresses a scan signal to the scanning line 31 by line sequential in pulse to predetermined timing based on a power source, a reference clock; etc. which are supplied from an external control circuit.
[0053] Based on a power source, a reference clock signal, etc. which are supplied from an external control circuit, according to the timing which impresses a scan signal, a sampling circuit driving signal is minded every data line 35, and the scanning-line drive circuit 104 minds [301] the sampling circuit drive signal line 306, and carries out sequential supply of the data-line drive circuit 101 to predetermined timing about six picture signal line 304 each.
[0054] The precharge circuit 201 is equipped with TFT202 every data line 35, the precharge signal line 204 is connected to the source electrode of TFT202, and the precharge circuit drive signal line 206 is connected to the gate electrode of TFT202. And the power source of a predetermined electrical potential difference required in order to write in a precharge signal (NRS) from an external power is supplied through the precharge signal line 204, and a precharge circuit driving signal (NRG) is supplied from an external control circuit so that a precharge signal may be written in through the precharge circuit drive signal line 206 to the timing preceded with a picture signal (VID1-VID6) about each data line 35. The precharge circuit 201 supplies the precharge signal (image auxiliary signal) which is preferably equivalent to the pixel data of middle gradation level.
[0055] The sampling circuit 301 is equipped with TFT302 every data line 35, the picture signal line 304 is connected to the source electrode of TFT302, and the sampling circuit drive signal line 306 is connected to the gate electrode of TFT302. And if six parallel picture signals (VID1-VID6) are inputted through the picture signal line 304, these picture signals (VID1-VID6) will be sampled. Moreover, if a sampling circuit driving signal is inputted from the data-line drive circuit 101 through the sampling circuit drive signal line 306, sequential impression of the picture signal sampled about six picture signal line 304 each will be carried out at the data line 3. That is, the data-line drive circuit 101 and the sampling circuit 301 are constituted so that the parallel picture signal (VID1-VID6) which was inputted from the picture signal line 304 and which was developed six phases may be supplied to the data line 35. Although the gestalt of this operation described the method which makes sequential selection of the data line 35 for [every], the method which chooses as coincidence the sampling circuit 301 connected to the six adjoining data lines 35, for example, and consists of the six data lines 35 and which carries out the sequential transfer for every group may be used. Selection of the data line 35 may choose as coincidence 2 which adjoins each other, 3, --, 5, or 7 or more. Moreover, as long as the write-in property of TFT302 which constitutes not only six phases but the sampling circuit 301 of the number of phase expansions of the picture signal supplied to the data line 35 is good, five or less phases are sufficient as it, and as long as the dot frequency of a picture signal is high, it may be increased to seven or more phases. Under the present circumstances, it cannot be overemphasized that the image image input signal line only of the number of phase expansions of a picture

signal is the need at least.
[0056] Especially with the gestalt of this operation, the protection-from-light layer 3 (it mentions later) is formed in the TFT302 bottom which TFT30 prepared in each pixel, TFT202 which the precharge circuit 201 has, and a sampling circuit 301 have, respectively. Therefore, even if return light etc. carries out incidence from the TFT array substrate 1 side, before carrying out incidence to TFT 30,202 and 302, this return light etc. is shaded by the protection-from-light layer 3 formed in the location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effectiveness in TFT 30,202 and 302, and transistor characteristics deteriorate is prevented beforehand, and the defect who spoils image quality grace, such as a flicker and a cross talk, remarkably is not generated. In addition, about the concrete lamination of the protection-from-light layer 3, it mentions later.
[0057] Moreover, with the gestalt of this operation, the protection-from-light layer 3 of TFT 30,202 and 302 formed in the bottom of a channel field at least is electrically connected with a constant potential line like touch-down potential. This is for preventing change of the transistor characteristics which happen when the unstable potential difference arises between each terminal of TFT 30,202 and 302. As a constant potential line, you may connect with wiring which supplies counterelectrode potential to the power source of the forward potential supplied to the data-line drive circuit 101 or scanning-line drive circuit 104 grade, or negative potential, and the opposite substrate 2 electrically, for example. As shown in drawing 1 , the constant potential line 501 installed from the power source of the negative potential of the scanning-line drive circuit 104 etc. is electrically connected to the protection-from-light layer 3 around the screen-display field. Moreover, you may use with the constant potential line 501 supplied to capacity line 31' for forming the storage capacitance of a pixel in common. If such a configuration is taken, since leading-about wiring can be managed with one, it is advantageous, in case the tooth space which makes a circumference circuit spreads or liquid crystal equipment is miniaturized. Moreover, since the external input terminal of dedication is not needed, a leeway is given to a tooth space and the cost cut of a mounting member can be aimed at. However, it cannot be overemphasized that the external input terminal of dedication and wiring may be prepared and constant potential may be supplied.
[0058] Furthermore, in this way, since protection from light is given to the return light from the TFT array substrate 1 side about the precharge circuit 201 or the sampling circuit 301, the need of arranging these circuits into the circumference part of the TFT array substrate 1 into which it was put by the case of protection-from-light nature like before is lost. So, with the gestalt of this operation, as the slash field in drawing 1 shows, and as it is shown in drawing 2 and drawing 3 , the precharge circuit 201 and the sampling circuit 301 are formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature formed in the opposite substrate 2. On the other hand, the data-line drive circuit 101 and the scanning-line drive circuit 104 are formed on the narrow long and slender circumference part of the TFT array substrate 1 which does not face the liquid crystal layer 50.
[0059] In drawing 2 and drawing 3 , the sealant 52 which consists of a photo-setting resin as an example of the seal member which sticks both substrates in the perimeter of the screen-display field (namely, field of the liquid crystal equipment with which an image is actually displayed by the orientation change of state of the liquid crystal layer 50) specified with two or more pixel electrodes 11, and surrounds the liquid crystal layer 50 is formed along the screen-display field on the TFT array substrate 1. And between the screen-display fields and sealants 52 on the opposite substrate 2, the circumference abandonment 53 of protection-from-light nature is formed.
[0060] When put into the TFT array substrate 1 by the case of protection-from-light nature where opening was behind prepared corresponding to the screen-display field, the circumference abandonment 53 so that the screen-display field concerned may not hide in the edge of opening of the case concerned according to a manufacture error etc. That is, it is formed from the band-like protection-from-light nature ingredient which has width of face of 500 micrometers or more in the perimeter of a screen-display field so that the gap of about hundreds of micrometers to the case of the TFT array substrate 1 may be permitted, for example. Such circumference abandonment 53 of protection-from-light nature is formed in the opposite substrate 2 of sputtering and the photolithography which used metallic materials, such as Cr (chromium), nickel (nickel), and aluminum (aluminum), and etching. Or it is formed from ingredients, such as resin black which distributed carbon and Ti (titanium) to the photoresist.
[0061] The data-line drive circuit 101 and the mounting terminal 102 are formed in the field of the outside of a sealant 52 along the lower side of a screen-display field, and the scanning-line drive circuit 104 is established in it along with two sides of right and left of a screen-display field. Furthermore, two or more wiring 105 for connecting between the scanning-line drive circuits 104 established in the both sides of a

screen-display field is formed in the surface of a screen-display field. Moreover, in at least one place of the corner section of the opposite substrate 2, the fish eye 106 which consists of flow material for taking an electric flow between the TFT array substrate 1 and the opposite substrate 2 is formed. And the opposite substrate 2 with the almost same profile as a sealant 52 has fixed to the TFT array substrate 1 by the sealant 52 concerned.

[0062] The precharge circuit 201 and a sampling circuit 301 are circuits of an alternating current drive fundamentally. For this reason, even if it establishes these precharge circuits 201 and sampling circuits 301 in TFT array substrate 1 part which faces the liquid crystal layer 50 which was surrounded by the sealant 52 and pinched among both substrates, the problem of degradation of the liquid crystal layer 50 by direct-current-voltage impression is not produced. On the other hand, the data-line drive circuit 101 and the scanning-line drive circuit 104 are established in the circumference part of the TFT array substrate 1 which does not face the liquid crystal layer 50. Therefore, it can prevent beforehand that the direct-current-voltage component from the data-line drive circuit 101 or the scanning-line drive circuit 104 by which especially a direct-current drive is carried out leaks to the liquid crystal layer 50, and is impressed to it.

[0063] Thus, it becomes easy to design these circumference circuits so that it can have allowances, the scanning-line drive circuit 104 and the data-line drive circuit 101 can be formed in the circumference part of the TFT array substrate 1 by forming the precharge circuit 201 and a sampling circuit 301 and it may meet under the circumference abandonment 53 at a specific specification. Moreover, reduction of the display area in liquid crystal equipment 200 is not caused by establishing the precharge circuit 201 and a sampling circuit 301 in the bottom of the circumference abandonment 53 which is dead space so to speak.

[0064] And since the circumference abandonment 53 is protection-from-light nature in one side, there is no need of establishing separately the protection-from-light means against the incident light which carries out incidence from the opposite substrate 2 side on the precharge circuit 201 or a sampling circuit 301 (namely, TFT 202 and 302). On the other hand, a protection-from-light layer can shade the return light of the precharge circuit 201 or a sampling circuit 301 (namely, TFT 202 and 302) which carries out incidence from the TFT array substrate 1 side since it is prepared in the bottom of a channel field at least, before reaching the precharge circuit 201 and a sampling circuit 301 (namely, TFT 202 and 302). Thereby, since there is nothing of TFT202 of the precharge circuit 201 or TFT302 of a sampling circuit 301 for which light is irradiated by the channel field at least, in this field, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the transistor characteristics of TFT 202 and 302 do not deteriorate. Therefore, even if light carries out incidence of the gestalt of this operation from which liquid crystal equipment side, it has the advantage in which it can shade certainly and can abolish the defect who reduces image quality grace, such as a flicker and a cross talk, remarkably.

[0065] In addition, since neither the precharge circuit 201 nor a sampling circuit 301 is necessarily formed in TFT array substrate 1 part which faces a sealant 52, there is no possibility of destroying TFT 202 and 302 which constitutes these circuits with the spacer mixed in the sealant 52, and it can fully irradiate light from both the substrates side further at the process to which photo-curing of the sealant 52 is carried out.

[0066] As shown in drawing 1 , with the gestalt of this operation, a picture signal is supplied from the end which two or more data lines 35 have the lower side of a screen-display field, and a precharge signal is supplied from the other end in an another side side. Therefore, the precharge circuit 201 can be established in an opposite side across the data-line drive circuit 101 and the sampling circuit 301, and screen-display field for supplying a picture signal, and the tooth space under the circumference abandonment 53 can be effectively used with sufficient balance.

[0067] Next, the concrete circuitry of TFT 202 and 302 which constitutes the precharge circuit 201 and a sampling circuit 301 is explained with reference to drawing 4 and drawing 5 , respectively. In addition, drawing 4 is the circuit diagram showing various kinds of TFT(s) which constitute TFT202 of the precharge circuit 201, and drawing 5 is the circuit diagram showing various kinds of TFT(s) which constitute TFT302 of a sampling circuit 301.

[0068] As shown in drawing 4 (1), TFT202 (refer to drawing 1) of the precharge circuit 201 may consist of N channel mold TFT202a, as shown in drawing 4 (2), may consist of P channel mold TFT202b, and may consist of complementary-type TFT202c which consists of the N channel mold TFT and the P channel mold TFT as shown in drawing 4 (3). In addition, the precharge circuit driving signals 206a and 206b inputted in drawing 4 (3) through the precharge circuit drive signal line 206 shown in drawing 1 from drawing 4 (1) are inputted into each TFT(s) 202a-202c as gate voltage. The precharge signal NRS inputted through the precharge signal line 204 similarly shown in drawing 1 is inputted into each TFT(s) 202a-202c as a source electrical potential difference. Precharge circuit driving signal 206a impressed to N channel mold TFT202a

as gate voltage and precharge circuit driving signal 206b impressed to P channel mold TFT202b as gate voltage are reversal signals mutual. Therefore, in constituting the precharge circuit 201 from complementary-type TFT202c, at least two or more precharge circuit drive signal lines 206 are needed. Thus, when the precharge circuit drive signal line 206 becomes two or more, one screen-display field side may be wired intensively, and you may wire from the both sides of a screen-display field combining the precharge signal line 204. Or for example, precharge circuit driving signal 206a may be reversed with an inverter before complementary-type TFT202c, and precharge circuit driving signal 206b may be formed.
[0069] As shown in drawing 5 (1), TFT302 (refer to drawing 1) of a sampling circuit 301 may consist of N channel mold TFT302A, as shown in drawing 5 (2), it may consist of P channel mold TFT302B, and as shown in drawing 5 (3), it may consist of complementary-type TFT302C. In addition, the picture signal VID inputted in drawing 5 (3) through the picture signal line 304 shown in drawing 1 from drawing 5 (1) is inputted into each TFT(s) 302a-302c as a source electrical potential difference. The sampling circuit driving signals 306a and 306b inputted through the sampling circuit drive signal line 306 from the data-line drive circuit 101 similarly shown in drawing 1 are inputted into each TFT(s) 302a-302c as gate voltage. Moreover, also in a sampling circuit 301, sampling circuit driving signal 306a impressed to N channel mold TFT302a as gate voltage and sampling circuit driving signal 306b impressed to P channel mold TFT302B as gate voltage are reversal signals like the case of the above-mentioned precharge circuit 201 mutual. Therefore, in constituting a sampling circuit 301 from complementary-type TFT302C, sampling circuit driving signal 306a and at least two or more sampling circuit drive signal lines 306 for 306b are needed.
[0070] (Configuration of liquid crystal equipment) Next, the concrete configuration of the liquid crystal equipment part which liquid crystal equipment 200 contains is explained with reference to drawing 8 from drawing 6 . here -- drawing 7 -- drawing 1 -- setting -- a circle -- surrounding -- having had -- D -- a field -- having expanded -- a top view -- it is -- drawing 6 -- drawing 7 -- it can set -- TFT -- 30 -- A-A -- ' -- having met -- a sectional view -- precharge -- a circuit -- 201 -- TFT -- 202 -- B-B -- ' -- having met -- a sectional view -- expressing -- **** . In addition, in order to make each class and each part material into the magnitude of extent which can be recognized on a drawing, scales are made to have differed for each class or every each part material in drawing 6 .
[0071] In TFT30 part in which liquid crystal equipment 200 is formed in each pixel in the sectional view of drawing 6 It has [between the protection-from-light layer 3 by which the laminating was carried out to the TFT array substrate 1 list on it, and the 1st layer] an insulating layer 43, the pixel electrode 11, and the orientation film 12 between an insulating layer 42, the data line 35 (source electrode), and the 3rd layer between an insulating layer 41, the semi-conductor layer 32, the gate insulating layer 33, the scanning line 31 (gate electrode), and the 2nd layer. Liquid crystal equipment 200 is equipped with the common electrode 21, the orientation film 22, and the 2nd protection-from-light layer 23 by which the laminating was carried out to the opposite substrate 2 list which consists of a glass substrate on it again. Liquid crystal equipment 200 is further equipped with the liquid crystal layer 50 pinched among both these substrates.
[0072] Here, the configuration of each class except TFT30 is first explained in order among these layers.
[0073] In the location which counters TFT30, respectively, the protection-from-light layer 3 is formed on the TFT array substrate 1, respectively. The protection-from-light layer 3 consists of metal alloys, such as a metal containing at least one, such as Ti (titanium), Cr (chromium), W (tungsten), Ta (tantalum), Mo (molybdenum), and Pd (lead), or metal silicide (for example, tungsten silicide WSi). If a light-shielding film 3 is constituted from refractory metal silicide (i.e., if silicon is included in the ingredient of the protection-from-light layer 3), the TFT array substrate 1 which comes to contain silicon, and thermal affinity with the insulating layer 41 between the 1st layer will become good.
[0074] Moreover, as shown in drawing 7 , the protection-from-light layer 3 is grounded through the constant potential line 501 through the contact hole 503, or is connected to the constant source of potential. It is good to install wiring of the power source supplied to the data-line drive circuit 101 or the circumference circuit of scanning-line drive circuit 104 grade as a constant potential line 501. For this reason, when the potential of the protection-from-light layer 3 changes, it does not have a bad influence on the switching characteristic of TFT30 etc. For example, it may be grounded, or it may connect with the common electrode 21, and the protection-from-light layer 3 may be made into the potential of the common electrode 21. However, the protection-from-light layer 3 may be floating electrically. Moreover, it is also possible to use the protection-from-light layer 3 as wiring for the below-mentioned storage capacitance (to refer to drawing 6).
[0075] Furthermore, between the protection-from-light layer 3 and two or more TFT30, the insulating layer 41 is formed between the 1st layer. Between the 1st layer, it consists of silicate glass film, such as NSG (non dope silicate glass), PSG (phosphorus silicate glass), BSG (boron silicate glass), and BPSG (boron

phosphorus silicate glass), a silicon nitride film, an oxidation silicone film, etc., and an insulating layer 41 is formed in order to carry out the electric insulation of the semi-conductor layer 32 which constitutes TFT30 from the protection-from-light layer 3. Furthermore, an insulating layer 41 also has a function as substrate film for TFT30 by being formed all over the TFT array substrate 1 between the 1st layer. That is, it has the function to prevent degradation of the property of TFT30 with the dry area at the time of polish of the front face of the TFT array substrate 1, the dirt which remains after washing.

[0076] An insulating layer 43 consists of silicate glass film, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, an oxidation silicone film, etc. between an insulating layer 42 and the 3rd layer between the 2nd layer, respectively.

[0077] The pixel electrode 11 consists of transparent conductive thin films, such as for example, ITO film (indium Tin oxide film). In addition, when using the liquid crystal equipment 200 concerned for the liquid crystal equipment of a reflective mold, the pixel electrode 11 may be formed from an opaque ingredient with high reflection factors, such as aluminum.

[0078] Rubbing processing is performed in the predetermined direction so that the orientation film 12 may consist of organic thin films, such as for example, a polyimide thin film, and it may have a predetermined pre tilt angle.

[0079] It goes across the common electrode 21 all over the opposite substrate 2, and it is formed from the ITO film etc.

[0080] Rubbing processing is performed in the predetermined direction so that the orientation film 22 may consist of organic thin films, such as for example, a polyimide thin film, and it may have a predetermined pre tilt angle.

[0081] The 2nd protection-from-light layer 23 is formed in the predetermined field which counters TFT30 from ingredients, such as resin black which distributed metallic materials and carbon, such as Cr and nickel, and Ti to the photoresist. The 2nd protection-from-light layer 23 has functions other than the protection from light to the semi-conductor layer 32 of TFT30, such as improvement in contrast, and color mixture prevention of color material.

[0082] The liquid crystal layer 50 is formed when liquid crystal is enclosed with the space surrounded by the sealant 52 (refer to drawing 2 and drawing 3) between the TFT array substrates 1 and the opposite substrates 2 which have been arranged so that the pixel electrode 11 and the common electrode 21 may meet by vacuum suction etc. The liquid crystal layer 50 takes a predetermined orientation condition with the orientation film 12 and 22 in the condition that the electric field from the pixel electrode 11 are not impressed. The liquid crystal layer 50 consists of liquid crystal which mixed the pneumatic liquid crystal of a kind or some kinds. It is the adhesives which consist of a photo-setting resin or thermosetting resin in order that a sealant 52 may stick two substrates 1 and 2 around those, and the spacer for making distance between both substrates into a predetermined value is mixed.

[0083] Next, the configuration of each class concerning TFT30 is explained in order.

[0084] TFT30 is equipped with the source field 34 formed in the gate insulating layer 33 which insulates the semi-conductor layer 32 in which a channel is formed of the electric field from the scanning line 31 (gate electrode) and the scanning line 31, and the scanning line 31 and the semi-conductor layer 32, and the semi-conductor layer 32, the data line 35 (source electrode), and the drain field 36 formed in the semi-conductor layer 32. One to which it corresponds of two or more pixel electrodes 11 is connected to the drain field 36. The source field 34 and the drain field 36 are formed by doping the object for the N type of predetermined concentration, or the dopant for P type to the semi-conductor layer 32 like the after-mentioned according to whether TFT of N type or P type is formed. TFT of an N type channel has the advantage that a working speed is quick, and it is used as TFT30 which is the switching element of a pixel in many cases.

[0085] TFT30 has LDD structure preferably. However, TFT30 may have the offset structure where an ion implantation is not performed in the low-concentration source drain field in LDD structure, and may form the source field 34 and the drain field 36 in self align by using the gate electrode 31 as a mask. You may be TFT of a self aryne mold. Moreover, with the gestalt of this operation, although single gate structure showed TFT30, between the source field 34 and the drain field 36, the dual gate structure which arranged the gate electrode 31 in the two-piece serial is sufficient, and three or more gate electrodes 31 may be arranged. If such structure is taken, since the leakage current at the time of OFF of TFT30 will be reduced, degradation of image quality grace is not caused.

[0086] The scanning line 31 (gate electrode) is preferably formed from the polish recon film. Or it may be formed from the refractory metal film or metal silicide film, such as W and Mo. in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature

which the metal membrane metallurgy group silicide film has if the 2nd protection-from-light layer 23 arranges the scanning line 31 (gate electrode) as the part or the light-shielding film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially.

[0087] The gate insulating layer 33 consists of thermal oxidation film of comparatively thin thickness. In addition, when using a large-sized substrate 8 inches or more, in order to prevent the camber of the substrate by heat, thermal oxidation time amount is shortened, the thermal oxidation film is made thin, a high-temperature-oxidation silicone film (HTO film) and a silicon nitride film are deposited with a CVD method etc. on this thermal oxidation film, and the multilayer gate-dielectric-film structure more than two-layer may be formed.

[0088] Although a photocurrent will occur according to the photo-electric-conversion effectiveness which the polish recon film has and the transistor characteristics of TFT30 will deteriorate if light carries out incidence of the semi-conductor layer 32 in which a channel is generally formed With the gestalt of this operation, since two or more 2nd protection-from-light layers 23 are formed in the location which counters the opposite substrate 2 at each TFT30, respectively to light, such as incident light from the opposite substrate 2 side, the thing of the semi-conductor layer 32 done to a channel field for incidence at least is prevented for the incident light on which it was projected. By the way, the 2nd protection-from-light layer 23 formed on the opposite substrate 2 may be formed on the TFT array substrate 1. In this case, if Ti (titanium) etc. is formed through an insulator layer, respectively between the data line 35 and the pixel electrode 11, the 2nd protection-from-light layer 23 on the opposite substrate 2 is omissible. Therefore, since it is not necessary to take into consideration the alignment precision at the time of the assembly of the opposite substrate 2 and the TFT array substrate 1, liquid crystal equipment without dispersion in permeability can be offered.

[0089] The data line 35 (source electrode) may be formed from transparent conductive thin films, such as ITO film, like the pixel electrode 11. Or you may form from low resistance metal metallurgy group silicide, such as aluminum, etc.

[0090] furthermore, the gate electrode of TFT30 which replaces with in addition to this and consists of a part of scanning line 31 -- the wrap from a top -- if the data line 35 (source electrode) is formed from opaque metal thin films, such as aluminum, like -- the 2nd protection-from-light layer 23 -- or independent -- the semi-conductor layer 32 -- the exposure of the incident light (namely, drawing 6 light from a top) to a channel field can be prevented effectively at least. Here, the data line 35 is good in TFT30 to form so that the joint of the channel field of the semi-conductor layer 32 and the source drain fields 34 and 36 and the protection-from-light layer 3 arranged in these lower parts may be covered at least. This is for preventing the light which carried out incidence from the opposite substrate 2 side reflecting on the front face of the protection-from-light layer 3, and irradiating a channel field. On the other hand, since two or more protection-from-light layers 3 are formed in the location which counters the TFT array substrate 1 at each TFT30, respectively to light, such as return light from the TFT array substrate 1 side, the thing of the semi-conductor layer 32 done to a channel field for incidence at least is prevented for return light etc.

[0091] Moreover, the contact hole 38 which leads to the contact hole 37 and the drain field 36 which lead to the source field 34 is formed in the insulating layer 42 between the 2nd layer, respectively. Electrical installation of the data line 35 (source electrode) is carried out to the source field 34 through the contact hole 37 to this source field 34. Furthermore, the contact hole 38 to the drain field 36 is formed in the insulating layer 43 between the 3rd layer. Electrical installation of the pixel electrode 11 is carried out to the drain field 36 through the contact hole 38 to this drain field 36. The above-mentioned pixel electrode 11 is formed in the top face of an insulating layer 43 between the 3rd layer constituted in this way.

[0092] Here, as shown in the top view of drawing 7 , the pixel electrode 11 constituted as mentioned above is arranged in the shape of a matrix on the TFT array substrate 1, adjoins each pixel electrode 11, and TFT30 is formed, and the data line 35 (source electrode) and the scanning line 31 (gate electrode) are formed respectively along the boundary of the pixel electrode 11 in every direction. Moreover, it turns out that the protection-from-light layer 3 has covered the channel part of TFT30 etc. from the bottom. In drawing 7 , the constant potential line 501 installed from the power source of the negative potential of the scanning-line drive circuit 104 located in the direction of C is arranged to the nearest to a screen-display field. Here, it connects with the protection-from-light layer 3 electrically through a contact hole 503. The protection-from-light layer 3 is arranged in the lower part in parallel along with the scanning line 31. Moreover, even if there is little TFT202 of the precharge circuit 201, protection-from-light layer 3" is formed so that the bottom of

the channel field of semi-conductor layer 32" may be covered, and, on the other hand, a screen-display field is wired in parallel with the scanning line 31 from an edge to the edge of the opposite side. Furthermore, it connects with the constant potential line 501 electrically through a contact hole 503 so that transistor characteristics may not deteriorate. Moreover, by forming the constant potential line 501, the precharge circuit 201, the precharge circuit drive signal line 206, and precharge signal-line 204 grade in the bottom of the circumference abandonment 53 which was dead space conventionally, the field which makes a circumference circuit can be expanded or the miniaturization of liquid crystal equipment can be realized. In addition, drawing 7 is on account of explanation to simplify and show the matrix-like array of the pixel electrode 11 etc., and each actual electrode has the more [in three dimension] complicated configuration so that it may wire through the contact hole etc. and drawing 6 may show between layer insulation layers and a top.

[0093] In drawing 6 , storage capacitance 70 is again formed in the pixel electrode 11, respectively. 1st storage capacitance electrode 32' by which installation formation was more specifically [this storage capacitance 70] carried out from the drain field 36 of the semi-conductor layer 32, insulating-layer 33' formed of the same process as the gate insulating layer 33, and the capacity line 31 formed of the same process as the scanning line 31 -- ' (the 2nd storage capacitance electrode) -- It consists of some of insulating layers 42 and 43 and pixel electrodes 11 which counter a list at capacity line 31' through the 2nd and the insulating layers 42 and 43 between the 3rd layer between the 2nd and the 3rd layer. Thus, since storage capacitance 70 is formed, even if duty ratio is small, a high definition display is enabled. Moreover, as shown in drawing 7 , the constant potential line 501 and capacity line 31' which were installed from the scanning-line drive circuit 104 can be used as a constant potential source of supply by connecting electrically in a contact hole 502. Since the protection-from-light layer 3 and a constant potential line can be shared by this, wiring can be managed with one and it is advantageous in leading about of wiring. Furthermore, since it is not necessary to prepare the external input terminal of dedication, the number of input terminals can be reduced.

[0094] In drawing 6 , TFT202 (refer to drawing 1) of the precharge circuit 201 is formed in liquid crystal equipment 200 every data line 35. this -- TFT -- 202 -- more -- concrete -- a semi-conductor -- a layer -- 32 - - the same -- a process -- forming -- having -- a semi-conductor -- a layer -- 32 -- " -- the gate -- an insulating layer -- 33 -- the same -- a process -- forming -- having -- the gate -- an insulating layer -- 33 -- " -- and -- the scanning line -- 31 (gate electrode) -- the same -- a process -- forming -- having -- precharge -- a circuit - - a drive -- a signal line -- 206 (gate electrode) -- having -- **** . a semi-conductor -- a layer -- 32 -- " -- **** -- TFT -- 30 -- a case -- the same -- the source -- a field -- 34 -- " -- and -- a drain -- a field -- 36 -- " -- preparing -- having -- the -- two -- a layer -- between -- an insulating layer -- 42 -- opening -- having had -- a contact hole -- 38 -- " -- leading -- a drain -- a field -- 36 -- " -- **** -- the data line -- 35 -- connecting -- having -- **** . Moreover, the precharge signal line 204 is connected to source field 34" through contact hole 37" which was able to be opened in the insulating layer 42 between the 2nd layer. And it is prepared so that protection-from-light layer 3" formed of the same process as the protection-from-light layer 3 on the TFT array substrate 1 in the location which counters TFT202 with such layer structure may cover the bottom of the channel field of semi-conductor layer 32" at least. And TFT202 is formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature prepared in the opposite substrate 2. It enables this to form a circumference circuit in the nearest to the opening field which light penetrates.

[0095] As shown in the top view of drawing 7 , as for the precharge circuit 201, the precharge signal line 204, the precharge circuit drive signal line 206, and the data line 35 are arranged in parallel. In addition, it is not necessary to necessarily arrange a pattern layout in parallel. Electrical installation of the precharge signal line 204 is carried out to each source field of TFT202 through each contact hole 37", and electrical installation of the data line 35 is carried out to each drain field of TFT202 through each contact hole 38." Moreover, opposite arrangement of the precharge circuit drive signal line 206 is carried out through gate dielectric film as a gate electrode of TFT202 at the channel part which connects these source fields and drain fields. And protection-from-light layer 3" is prepared so that a channel part may be covered with a top view with a gate electrode.

[0096] In addition, although not illustrated to drawing 7 , TFT302 (refer to drawing 1) of a sampling circuit 301 is constituted like TFT202 of the precharge circuit 201, and protection-from-light layer 3" is prepared on the TFT array substrate 1 in the location which counters TFT302. And TFT302 is formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature prepared in the opposite substrate 2.

[0097] Since it is the same film formation process at the time of formation of TFT30 since TFT30 is TFT which uses the polish recon film as a semi-conductor layer, and it can form a sampling circuit 201, the precharge circuit 301, the data-line drive circuit 101, and the circumference circuit of scanning-line drive circuit 104 grade especially with the gestalt of this operation, it is advantageous on manufacture. For example, the data-line drive circuit 101 and the scanning-line drive circuit 104 are formed in the circumference part on the TFT array substrate 1 from two or more TFT(s) of the complementary structure which consists of an N channel mold TFT and a P channel mold TFT like the case of the precharge circuit 201 and sampling circuit 301 which were shown in drawing 4 (3) and drawing 5 (3).
[0098] Thus, with the gestalt of this operation, since the protection-from-light layer 3 is formed in the channel field bottom at least, respectively and the bad influence by return light etc. of TFT 30,202 and 302 is reduced as mentioned above, the transistor characteristics of TFT30 are improved and, finally liquid crystal equipment 200 enables it to display an image high-definition by high contrast.
[0099] In addition, although not shown in drawing 6 , according to the exception of modes of operation, such as for example, TN (Twisted Nematic) mode, STN (super TN) mode, and D-STN (double-STN) mode, and the no MARI White mode / NOMA reeve rack mode, a polarization film, a phase contrast film, a polarization means, etc. are arranged in a predetermined direction at the side in which the incident light of the side in which the incident light of the opposite substrate 2 carries out incidence, and the TFT array substrate 1 carries out outgoing radiation, respectively.
[0100] Since the liquid crystal equipment 200 explained above is applied to an electrochromatic display projector, three liquid crystal equipments 200 will be used as a light valve for RGB, respectively, and incidence of the light of each color decomposed through the dichroic mirror for RGB color separation, respectively will be carried out to each liquid crystal equipment as incident light, respectively. Therefore, with the gestalt of each operation, the color filter is not prepared in the opposite substrate 2. However, the color filter of RGB may be formed in the predetermined field which counters the pixel electrode 11 with which the black matrix 23 is not formed in liquid crystal equipment 200 on the opposite substrate 2 with the protective coat. If it does in this way, the liquid crystal equipment of the gestalt of this operation is applicable to electrochromatic display equipments, such as electrochromatic display television of direct viewing types other than a liquid crystal projector, or a reflective mold. Furthermore, a micro lens may be formed so that it may correspond 1 pixel on [one] the opposite substrate 2. If it does in this way, bright liquid crystal equipment is realizable by improving the condensing effectiveness of incident light. Furthermore, the die clo IKKU filter which makes a RGB color using interference of light by depositing the interference layer to which the refractive index of many layers is different on the opposite substrate 2 again may be formed. According to this opposite substrate with a die clo IKKU filter, brighter electrochromatic display equipment is realizable.
[0101] Although [liquid crystal equipment 200] incidence of the incident light is carried out from the opposite substrate 2 side as usual, since the protection-from-light layer 3 and 3" exist, incidence of the incident light is carried out from the TFT array substrate 1 side, and it may be made to carry out outgoing radiation from the opposite substrate 2 side. That is, even if it attaches liquid crystal equipment 200 in a liquid crystal projector in this way, it is possible to be able to prevent the thing of the semi-conductor layer 32 for channel formation and 32" which light does for incidence to a channel field, and to display a high-definition image on it at least. In order to prevent the reflection by the side of the rear face of the TFT array substrate 1 conventionally, a polarization means by which AR coat was carried out for acid resisting needs to be arranged separately, and AR film needed to be stuck here. However, with the gestalt of this operation, since [of the front face of the TFT array substrate 1 the half-conductor-layer layer 32, and 32"] the protection-from-light layer 3 is formed between channel fields at least, such a polarization means and AR film by which AR coat was carried out are used, or the need of using the substrate which carried out AR processing of TFT array substrate 1 itself is lost. Therefore, according to the gestalt of this operation, ingredient cost can be reduced, and a contaminant, a blemish, etc. do not drop the yield at the time of polarization means attachment, and it is very advantageous.
[0102] Moreover, although it was explained that the switching element of liquid crystal equipment 200 was TFT of a forward stagger mold or coplanar mold structure, the gestalt of this operation is effective also to TFT of reverse stagger mold structure, or TFT of other formats.
[0103] Furthermore, in liquid crystal equipment 200, although the liquid crystal layer 50 was constituted from a pneumatic liquid crystal as an example, if the polymer dispersed liquid crystal which distributed liquid crystal as a minute grain in the macromolecule is used, the above-mentioned polarization film, a polarization means, etc. will become unnecessary in the orientation film 12 and 22 and a list, and the

advantage of a raise in the brightness of liquid crystal equipment or low-power-izing by efficiency for light utilization increasing will be acquired. Furthermore, when applying liquid crystal equipment 200 to high-reflective-liquid-crystal equipment by constituting the pixel electrode 11 from a metal membrane with high reflection factors, such as aluminum, SH (super HOMEOTORO pick) mold liquid crystal with which perpendicular orientation of the liquid crystal molecule was mostly carried out in the state of no electrical-potential-difference impressing may be used. Furthermore, although the common electrode 21 is provided in the opposite substrate 2 side in liquid crystal equipment 200 again so that perpendicular electric field (vertical electric field) may be impressed to the liquid crystal layer 50 What (that is, the electrode for horizontal electric-field generating is prepared in the TFT array substrate 1 side, without preparing the electrode for vertical electric-field generating in the opposite substrate 2 side) the pixel electrode 11 is constituted also for from an electrode for horizontal electric-field generating of a pair, respectively so that electric field (horizontal electric field) parallel to the liquid crystal layer 50 may be impressed is possible. Thus, if horizontal electric field are used, it is advantageous when extending an angle of visibility rather than the case where vertical electric field are used. In addition, it is possible to apply the gestalt of this operation to various kinds of liquid crystal ingredients (liquid crystal phase), a mode of operation, a liquid crystal array, the drive approach, etc.

[0104] (Actuation of an inspection circuit) With the gestalt of the operation explained above, although the precharge circuit 201 and the sampling circuit 301 were formed, it may replace with these or, in addition, the inspection circuit which has TFT for conducting predetermined inspection for inspecting the quality of the liquid crystal equipment concerned at the manufacture middle or the time of shipment, a defect, etc. may be established in the bottom of the circumference abandonment 53. An example of such an inspection circuit is shown in drawing 9 .

[0105] The inspection circuit 401 is equipped with two or more TFT402 in drawing 9 . The drive signal lines 403a and 403b for supplying the inspection circuit driving signals TX1 and TX2 to the gate of TFT402, respectively are connected. The inspection signal lines 404a-404d for supplying the inspection signals CX1-CX4, respectively are connected to the source of TFT402. And the data line 35 is connected to the drain of TFT402. In the case of inspection, TFT402 is alternatively turned on and off by the inspection circuit driving signals TX1 and TX2, and the inspection signals CX1-CX4 of a predetermined electrical potential difference, the precharge signal of a predetermined electrical potential difference, and the picture signal of a predetermined electrical potential difference are impressed. And the current value which flows to the inspection signal lines 404a-404d is measured, and it is compared with the current value in the defect-free article obtained experientially or theoretically beforehand. Consequently, inspection of the open circuit during wiring, short (short circuit) inspection during wiring, inspection of the circuit leak in the precharge circuit 201 or a sampling circuit 301, etc. can be conducted comparatively easily by impressing such applied voltage in the combination of a predetermined class, and measuring a current.

[0106] Thus, since protection from light of as opposed to [if the protection-from-light layer 3 is formed in the bottom of a channel field at least and an inspection circuit is prepared between the protection-from-light layer 3 and the circumference abandonment 53] the light from both the substrates side of TFT which an inspection circuit has is made also when preparing an inspection circuit, transistor characteristics do not deteriorate by light. Therefore, in case a screen is displayed on usual, image quality grace does not fall remarkably according to the leakage current from the inspection circuit which is not used. In addition, the scanning-line drive circuit 104 and the data-line drive circuit 101 can be formed in the circumference part of the TFT array substrate 1 with allowances, and reduction of the display area in liquid crystal equipment is not caused. In addition, you may make it prepare the precharge circuit of the inspection circuit combination which has the function of an inspection circuit like drawing 9 instead of preparing an inspection circuit like drawing 9 .

[0107] Furthermore, it may replace with the precharge circuit 201 and a sampling circuit 301, or, in addition, the circumference circuit which has TFT for electrical-potential-difference maintenance of the data-line drive circuit 101 and scanning-line drive circuit 104 grade for operating the liquid crystal equipment concerned as shown in drawing 8 may be established in the bottom of the circumference abandonment 53. These circumference circuits are formed so that the all or a part may lap with the circumference abandonment 53. If such a configuration is taken, a seal field can expand a circumference circuit field, if it is made to prepare in the outside of a circumference circuit, i.e., the outermost periphery of the TFT array substrate 1. Even if there is little TFT which a circumference circuit has also in this case, the protection-from-light layer 3 is formed in the bottom of a channel field. Thus, if a circumference circuit is prepared between the protection-from-light layer 3 and the circumference abandonment 53, since the

protection from light to the light from both the substrates side is made, transistor characteristics do not deteriorate by light (for example, thing which a maintenance electrical potential difference leaks). Even if it arranges such a circumference circuit under the circuit of an alternating current drive, then the circumference abandonment 53 especially, the problem of degradation of the liquid crystal layer 50 by the above-mentioned direct-current-voltage impression is not produced.

[0108] Moreover, you may make it connect with LSI for a drive mounted on TAB (tape automated bonding substrate) instead of forming the data-line drive circuit 101 and the scanning-line drive circuit 104 on the TFT array substrate 1 electrically and mechanically through the anisotropy electric conduction film prepared in the periphery of the TFT array substrate 1.

[0109] (Manufacture process) Next, the manufacture process of liquid crystal equipment 200 including the precharge circuit 201 and a sampling circuit 301 is explained with reference to drawing 12 from drawing 10 .

[0110] First, formation of TFT30 part in which the protection-from-light layer 3 was formed in the TFT array substrate 1 side is explained with reference to drawing 10 and drawing 11 .

[0111] As shown in the process (1) of drawing 10 , the TFT array substrates 1, such as a quartz substrate, hard glass, and a silicon substrate, are prepared. Here, preferably, annealing treatment is carried out at inert gas ambient atmospheres, such as N2 (nitrogen), and an about 900-1300-degree C elevated temperature, and it pretreats so that distortion produced in the TFT array substrate 1 in the elevated-temperature process carried out behind may decrease. That is, according to the temperature by which high temperature processing is carried out at the maximum elevated temperature in a manufacture process, the TFT array substrate 1 is heat-treated at the same temperature or the temperature beyond it in advance.

[0112] Thus, all over the processed TFT array substrate 1, by sputtering etc., it consists of metal alloys, such as a metal containing at least one, such as Ti, Cr, W, Ta, Mo, and Pd, or metal silicide, and the light-shielding film of about 1000-5000A thickness is formed. Then, the protection-from-light layer 3 is formed by forming the mask corresponding to the pattern of the protection-from-light layer 3 by the photolithography on the formed this light-shielding film, and etching to a light-shielding film through this mask.

[0113] In addition, the protection-from-light layer 3 is formed so that the field, the source field 34, and the drain field 36 for channel formation may be seen and covered from the rear face of the TFT array substrate 1 among the semi-conductor layers 32 of TFT30 at least.

[0114] Next, as shown in the process (2) of drawing 10 , while [the 1st layer] consisting of silicate glass film, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, an oxidation silicone film, etc. using TEOS (tetrapod ethyl orthochromatic silicate) gas, TEB (tetrapod ethyl boat rate) gas, TMOP (tetrapod methyl oxy-FOSU rate) gas, etc. with ordinary pressure or a reduced pressure CVD method, an insulating layer 41 is formed on the protection-from-light layer 3. The thickness of an insulating layer 41 has desirable about 500-15000A between the 1st layer. Or after forming the thermal oxidation film, a high-temperature-oxidation silicone film (HTO film) and a silicon nitride film are further deposited on the comparatively thin thickness of about 500A with a reduced pressure CVD method etc., and an insulating layer 41 may be formed between [with multilayer structure with a thickness of about 2000A] the 1st layer. Furthermore, the flat film may be formed by piling up or replacing with such silicate glass film, and carrying out the spin coat of the SOG (spin-on glass: spinning-like glass), or performing CMP (Chemical Mechanical Polishing) processing. Thus, if flattening of the top face of an insulating layer 41 is carried out by spin coat processing or CMP processing between the 1st layer, the advantage of being easy to form TFT30 behind in the bottom will be acquired.

[0115] In addition, between the 1st layer, to an insulating layer 41, by performing about 900-degree C annealing treatment, while preventing contamination, flattening may be carried out.

[0116] Next, as shown in the process (3) of drawing 10 , about 450-550 degrees C of amorphous silicon film are preferably formed comparatively on an insulating layer 41 between the 1st layer with the reduced pressure CVD (for example, CVD with a pressure of about 20-40Pa) using the mono-silane gas of flow rate about 400 to 600 cc/min, disilane gas, etc. of about 500 degrees C in a low-temperature environment. Then, in nitrogen-gas-atmosphere mind, at about 600-700 degrees C, preferably, solid phase growth of the polish recon film is carried out by ****** which performs annealing treatment of 4 - 6 hours for about 1 to 10 hours until it becomes the thickness of about 1000A preferably in about 500-2000A thickness. Under the present circumstances, when creating TFT of an N channel mold, the dopant of V group elements, such as Sb (antimony), As (arsenic), and P (Lynn), may be slightly doped by an ion implantation etc. Moreover, in using TFT as a P channel mold, it dopes slightly the dopant of III group elements, such as aluminum

(aluminum), B (boron), Ga (gallium), and In (indium), by an ion implantation etc. In addition, the polish recon film may be directly formed with a reduced pressure CVD method etc. without passing through the amorphous silicon film. Or drive silicon ion into the polish recon film deposited with the reduced pressure CVD method etc., once make it amorphous (amorphous-izing), it is made to recrystallize by annealing treatment etc. after that, and the polish recon film may be formed.

[0117] Next, as shown in the process (4) of drawing 10 , the thermal oxidation film with a comparatively thin thickness of about 300A is formed for the semi-conductor layer 32 the temperature of about 900-1300 degrees C, and by oxidizing thermally with the temperature of about 1000 degrees C preferably, a high-temperature-oxidation silicone film (HTO film) and a silicon nitride film are further deposited on the comparatively thin thickness of about 500A with a reduced pressure CVD method etc., and the gate insulating layer 33 with multilayer structure is formed. consequently, the thickness of the semi-conductor layer 32 -- the thickness of about 300-1500A -- desirable -- the thickness of about 350-450A -- becoming -- the thickness of the gate insulating layer 33 -- the thickness of about 200-1500A -- it becomes the thickness of about 300A preferably. Thus, by shortening elevated-temperature thermal oxidation time amount, when using especially an about 8 inches large-sized substrate, the camber by heat can be prevented. However, the gate insulating layer 33 with monolayer structure may be formed only by oxidizing the semi-conductor layer 32 thermally.

[0118] Next, as shown in the process (5) of drawing 10 , after depositing the polish recon film with a reduced pressure CVD method etc. through the gate insulating layer 33 on the semi-conductor layer 32, the gate electrode 31 (scanning line) is formed according to a photolithography process, an etching process, etc.

[0119] However, the gate electrode 31 (scanning line) may be formed in a multilayer combining not the polish recon film but the refractory metal film or the metal silicide film, and the p-Si film. in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature which the metal membrane metallurgy group silicide film has if the 2nd protection-from-light layer 23 arranges the gate electrode 31 (scanning line) as the part or the light-shielding film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially.

[0120] Next, as shown in the process (6) of drawing 11 , when TFT30 is set to TFT of an N channel mold with LDD structure, In order to form the low concentration dope field which constitutes the part which adjoins the semi-conductor layer 32 among the source field 34 and the drain field 36 first at a channel side, respectively The gate electrode 31 is used as a diffusion mask. The dopant of V group elements, such as P, by low concentration It dopes. (for example, P ion -- dose of one to 3x1013-/cm2) then, after forming a resist layer on the gate electrode 31 with a mask with width of face wider than the gate electrode 31, similarly the dopant of V group elements, such as P, is doped by high concentration (for example, P ion -- the dose of one to 3x1015-/cm2). Moreover, in the semi-conductor layer 32, when using TFT30 as a P channel mold, in order to form the source field 34 and the drain field 36, the dopant of III group elements, such as B, is used and doped. Thus, when it considers as LDD structure, the advantage which can reduce the short channel effect is acquired. In addition, it is not necessary to dope by dividing into two steps, low concentration and high concentration, in this way. For example, it is good also as TFT of offset structure, without performing a low-concentration dope, and it is good also as TFT of a self aryne mold by the ion-implantation technique using P ion, B ion, etc., using the gate electrode 31 as a mask.

[0121] In parallel to these processes, the data-line drive circuit 101 and the scanning-line drive circuit 104 with the complementary-type structure which consists of an N channel mold TFT and a P channel mold TFT are formed in the periphery on the TFT array substrate 1. Thus, since TFT30 is poly-Si TFT, at the time of formation of TFT30, it is the same process, and it can form the data-line drive circuit 101 and the scanning-line drive circuit 104, and is advantageous on manufacture.

[0122] next, it is shown in the process (7) of drawing 11 -- as -- the gate electrode 31 (scanning line) -- a wrap -- like, using ordinary pressure or a reduced pressure CVD method, TEOS gas, etc., while [the 2nd layer] consisting of silicate glass film, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, an oxidation silicone film, etc., an insulating layer 42 is formed. The thickness of an insulating layer 42 has desirable about 5000-15000A between the 2nd layer. And in order to activate the source field 34 and the drain field 36, after performing about 1000-degree C annealing treatment about 20 minutes, the contact hole 37 to the source electrode 35 (data line) is formed by dry etching, such as reactant etching and reactant ion beam etching. Under the present circumstances, there is an advantage that the direction which punctured the contact hole 37 can make a puncturing configuration almost the same as mask shape by anisotropic etching

like reactant etching and reactant ion beam etching. However, if it punctures combining dry etching and wet etching, since a contact hole 37 will be made in the shape of a taper, the advantage that the open circuit at the time of wiring connection can be prevented is acquired. Moreover, the contact hole for connecting with wiring which does not illustrate the gate electrode 31 (scanning line) is also opened in an insulating layer 42 between the 2nd layer according to the same process as a contact hole 37.

[0123] Next, as shown in the process (8) of drawing 11 , between the 2nd layer, on an insulating layer 42, low resistance metal metallurgy group silicide, such as aluminum, etc. is deposited on the thickness of about 1000-5000A by sputtering processing etc., and the source electrode 35 (data line) is further formed according to a photolithography process, an etching process, etc.

[0124] in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature which metal membrane metallurgy group silicide film, such as aluminum, has if the 2nd protection-from-light layer 23 arranges the source electrode 35 (data line) as the part or the light-shielding film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially. Moreover, the source electrode 35 is formed so that the channel field of the semi-conductor layer 32 may be covered at least, and it is made to cover with the source electrode 35 so that incident light may not be further irradiated directly by the front face of the protection-from-light layer 3 arranged in the channel field lower part of the semi-conductor layer 32. Thereby, since the channel field of the semi-conductor layer 32 can be protected from incident light and return light, the leakage current of TFT by the photo-electric-conversion effectiveness of the polish recon film can be reduced.

[0125] Next, using ordinary pressure or a reduced pressure CVD method, TEOS gas, etc., as shown in the process (9) of drawing 11 , while [the 3rd layer] consisting of silicate glass film, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, an oxidation silicone film, etc., an insulating layer 43 is formed, so that the source electrode 35 (data line) top may be covered. The thickness of an insulating layer 43 has desirable about 5000-15000A between the 3rd layer. or such silicate glass film -- replacing with -- or -- in piles -- the organic film and SOG (spin-on glass) -- a spin coat -- carrying out -- or -- or CMP processing may be performed and the flat film may be formed.

[0126] Furthermore, the contact hole 38 for carrying out electrical installation of the pixel electrode 11 and the drain field 36 is formed by dry etching, such as reactant etching and reactant ion beam etching. Under the present circumstances, the advantage that the direction which punctured the contact hole 38 can make a puncturing configuration almost the same as mask shape by anisotropic etching like reactant etching and reactant ion beam etching is acquired. However, if it punctures combining dry etching and wet etching, since a contact hole 38 will be made in the shape of a taper, the advantage that the open circuit at the time of wiring connection can be prevented is acquired.

[0127] Next, as shown in the process (10) of drawing 11 , between the 3rd layer, on an insulating layer 43, transparent conductive thin films, such as ITO film, are deposited on the thickness of about 500-2000A by sputtering processing etc., and the pixel electrode 11 is further formed according to a photolithography process, an etching process, etc. In addition, when using the liquid crystal equipment 200 concerned for the liquid crystal equipment of a reflective mold, the pixel electrode 11 may be formed from an opaque ingredient with high reflection factors, such as aluminum.

[0128] Then, after applying the coating liquid of the orientation film of a polyimide system on the pixel electrode 11, the orientation film 12 shown in drawing 1 is formed by performing rubbing processing in the predetermined direction so that it may have a predetermined pre tilt angle etc.

[0129] Next, protection-from-light layer 3" explains formation of TFT202 part of the precharge circuit 201 established in the TFT array substrate 1 side with reference to drawing 12 based on the B-B' sectional view of drawing 8 .

[0130] About formation of TFT202 part of the precharge circuit 201, the process (6) of drawing 11 is performed with the same film formation process from formation of TFT30 part explained with reference to drawing 10 and drawing 11 , and the process (1) of drawing 10 . Therefore, the explanation is omitted.

[0131] in this case -- the -- two -- a layer -- between -- an insulating layer -- 42 -- annealing treatment -- giving -- until -- drawing 11 -- a process -- (-- seven --) -- being the same -- although -- after that -- drawing 12 -- a process -- (-- seven --) -- being shown -- as -- precharge -- a signal line -- 204 -- receiving -- a contact hole -- 37 -- " -- the data line -- 35 -- receiving -- a contact hole -- 38 -- " -- the process (7) of drawing 11 -- being concurrent -- dry etching, such as reactant etching and reactant ion beam etching, -- forming .

[0132] Next, as shown in the process (8) of drawing 12 , low resistance metal metallurgy group silicide, such as aluminum, etc. is deposited by sputtering processing etc. on an insulating layer 42 between the 2nd

layer with the same film formation process as the process (8) of drawing 11 . Furthermore, in parallel to the process (8) of drawing 11 , the precharge signal line 204 and the data line 35 which have a predetermined pattern, respectively are formed according to a photolithography process, an etching process, etc.
[0133] Next, as shown in the process (9) of drawing 12 , while [the 3rd layer] consisting of silicate glass etc. with the same film formation process as the process (9) of drawing 11 so that the data-line 35 and precharge signal-line 204 top may be covered, an insulating layer 43 is formed. And about transparent conductive thin films, such as ITO film deposited on an insulating layer 43 between the 3rd layer with the film formation process of the process (10) of drawing 11 , all are removed by etching processing etc.
[0134] In addition, since it is the same as that of formation of TFT202 part of the above-mentioned precharge circuit 201 about formation of TFT302 part of the sampling circuit 301 where protection-from-light layer 3" was prepared in the TFT array substrate 1 side, the explanation is omitted.
[0135] (Electronic equipment) Next, the gestalt of operation of electronic equipment equipped with the liquid crystal equipment 200 explained to the detail above is explained with reference to drawing 18 from drawing 13 .
[0136] The outline configuration of the electronic equipment which equipped drawing 13 with liquid crystal equipment 200 in this way is shown first.
[0137] In drawing 13 , electronic equipment is constituted in preparation for the liquid crystal equipment 200 and the clock generation circuit 1008 list in which the drive circuit 1004 including the source 1000 of a display information output, the display information processing circuit 1002, the above-mentioned scanning-line drive circuit 104, and the data-line drive circuit 101, the precharge circuit constituted as mentioned above, and the sampling circuit were established in the power circuit 1010. The source 1000 of a display information output outputs display information, such as a picture signal of a predetermined format, to the display information processing circuit 1002 based on the clock signal from the clock generation circuit 1008 including memory, such as ROM (Read Only Memory), RAM (Random Access Memory), and an optical disk unit, a tuning circuit, etc. The display information processing circuit 1002 is constituted including various well-known processing circuits, such as magnification and a polarity-reversals circuit, a phase expansion circuit, a rotation circuit, a gamma correction circuit, and a clamping circuit, carries out sequential generation of the digital signal from the display information inputted based on the clock signal, and outputs it to the drive circuit 1004 with a clock signal CLK. The drive circuit 1004 drives liquid crystal equipment 200 by the above-mentioned drive approach the scanning-line drive circuit 104 and the data-line drive circuit 101. A power circuit 1010 supplies a predetermined power source to each above-mentioned circuit. In addition, on the TFT array substrate which constitutes liquid crystal equipment 200, the drive circuit 1004 may be carried and, in addition to this, the display information processing circuit 1002 may be carried.
[0138] Next, the example of the electronic equipment constituted in this way from drawing 14 by drawing 18 is shown, respectively.
[0139] Three liquid crystal modules containing the liquid crystal equipment with which the drive circuit 1004 which the liquid crystal projector 1100 mentioned above was carried on the TFT array substrate at drawing 14 are prepared, the outline block diagram of the optical system of a projection mold projector used as liquid crystal equipments 962R, 962G, and 962B for RGB, respectively is shown, and drawing 15 is the E-E' sectional view of drawing 14 . The light equipment 920 mentioned above and the homogeneity illumination-light study system 923 are adopted as the optical system of the projection mold display of this example. And the color separation optical system 924 as a color separation means by which a projection mold display separates into red (R), green (G), and blue (B) the flux of light W by which outgoing radiation is carried out from this homogeneity illumination-light study system 923, Three light valves 925R, 925G, and 925B as a modulation means to modulate each colored light bundles R, G, and B, It has the projector lens unit 6 as the color composition prism 910 as a color composition means to re-compound the colored light bundle after becoming irregular, and a delivery system which carries out expansion projection of the compounded flux of light on the front face of a plane of incidence 100. Moreover, it also has the light guide system 927 which leads the blue glow bundle B to corresponding light valve 925B.
[0140] The homogeneity illumination-light study system 923 is equipped with two lens plates 921 and 922 and reflective mirrors 931, and is arranged at the condition that two lens plates 921 and 922 intersect perpendicularly on both sides of the reflective mirror 931. Two lens plates 921 and 922 of the homogeneity illumination-light study system 923 are equipped with two or more rectangle lenses arranged in the shape of a matrix, respectively. The flux of light by which outgoing radiation was carried out from light equipment 920 is divided into two or more partial flux of lights by the rectangle lens of the 1st lens plate 921. And

these partial flux of lights are superimposed three light valves 925R and 925G and near 925B with the rectangle lens of the 2nd lens plate 922. Therefore, even when it has illuminance distribution with light equipment 920 uneven in the cross section of an outgoing beam by using the homogeneity illumination-light study system 923, it becomes possible to illuminate three light valves 925R, 925G, and 925B by the uniform illumination light.

[0141] Each color separation optical system 924 consists of a bluish green reflective dichroic mirror 941, a green reflective dichroic mirror 942, and a reflective mirror 943. First, in the bluish green reflective dichroic mirror 941, the blue glow bundle B included in the flux of light W and the green light bundle G are reflected by the right angle, and it goes to the green reflective dichroic mirror 942 side. This mirror 941 is passed, it is reflected by the right angle by the back reflective mirror 943, and outgoing radiation of the red flux of light R is carried out to the prism unit 910 side from the outgoing radiation section 944 of the red flux of light R.

[0142] Next, in the green reflective dichroic mirror 942, the green light bundle G is reflected by the right angle among the blue reflected in the bluish green reflective dichroic mirror 941, and the green light bundles B and G, and outgoing radiation is carried out to a color composition optical-system side from the outgoing radiation section 945 of the green light bundle G. Outgoing radiation of the blue glow bundle B which passed the green reflective dichroic mirror 942 is carried out to the light guide system 927 side from the outgoing radiation section 946 of the blue glow bundle B. In this example, it is set up so that the distance from the outgoing radiation section of the flux of light W of a homogeneity illumination-light study component to the outgoing radiation sections 944, 945, and 946 of each colored light bundle in the color separation optical system 924 may become almost equal.

[0143] Condenser lenses 951 and 952 are arranged at the outgoing radiation side of the red of the color separation optical system 924, and the outgoing radiation sections 944 and 945 of the green light bundles R and G, respectively. Therefore, incidence of the red and the green light bundles R and G which carried out outgoing radiation from each outgoing radiation section is carried out to these condenser lenses 951 and 952, and they are made parallel.

[0144] Thus, incidence of the red and the green light bundles R and G which were made parallel is carried out to light valves 925R and 925G, they are modulated, and the image information corresponding to each colored light is added. That is, according to image information, switching control of these liquid crystal equipments is carried out by the non-illustrated driving means, and, thereby, the modulation of each colored light which passes through this is performed. Such a driving means can use a well-known means as it is. On the other hand, the blue glow bundle B is led to light valve 925B which corresponds through the light guide system 927, and a modulation is similarly performed in here according to image information. In addition, the light valves 925R, 925G, and 925B of this example are liquid crystal light valves which consist of the incidence side polarization means 960R, 960G, and 960B, outgoing radiation side polarization means 961R, 961G, and 961B, and liquid crystal equipments 962R, 962G, and 962B arranged among these further, respectively.

[0145] The light guide system 927 consists of a middle lens 973 arranged between the condenser lens 954 arranged to the outgoing radiation side of the outgoing radiation section 946 of the blue glow bundle B, the incidence side reflective mirror 971, the outgoing radiation side reflective mirrors 972, and these reflective mirrors, and a condenser lens 953 arranged to the near side of light valve 925B. From a condenser lens 946, through the light guide system 927, the blue glow bundle B by which outgoing radiation was carried out is led to liquid crystal equipment 962B, and is modulated. The blue glow bundle B becomes the longest, therefore the quantity of light loss of a blue glow bundle of distance from the optical path length of each colored light bundle, i.e., the outgoing radiation section of the flux of light W, to each liquid crystal equipments 962R, 962G, and 962B increases most. However, quantity of light loss can be controlled by making the light guide system 927 intervene.

[0146] Incidence of each colored light bundles R, G, and B modulated through each light valves 925R, 925G, and 925B is carried out to the color composition prism 910, and they are compounded here. And expansion projection is carried out on the front face of the plane of incidence 100 which has the light compounded by this color composition prism 910 in a position through the projector lens unit 906.

[0147] With the gestalt of this operation, to the liquid crystal equipments 962R, 962G, and 962B Since the protection-from-light layer is prepared in the TFT bottom, the liquid crystal equipment 962R concerned, The reflected light by the incident light study system in the liquid crystal projector based on the incident light from 962G and 962B, Even if a part of incident light which runs through an incident light study system carries out incidence from a TFT array substrate side as a return light after carrying out outgoing radiation from the reflected light from the front face of the TFT array substrate at the time of incident light passing,

and other liquid crystal equipments Protection from light to channels, such as circumference circuits, such as TFT for switching of a pixel electrode or TFT of a sampling circuit, TFT of a PURICHAJINGU circuit, TFT of an inspection circuit or a data-line drive circuit, and a scanning-line drive circuit, can fully be performed.
[0148] For this reason, in a configuration, since it becomes unnecessary to arrange the film for return light prevention separately, or to perform return light prevention processing to a polarization means between each liquid crystal equipments 962R, 962G, and 962B and a prism unit even if it uses the prism unit suitable for a miniaturization for an incident light study system, small and when being simplified, it is very advantageous.
[0149] Moreover, with the gestalt of this operation, since the effect of the channel field on TFT by return light can be suppressed, it is not necessary to stick the polarization means which performed direct return light prevention processing to liquid crystal equipment. Then, as shown in drawing 14 and drawing 15 , a polarization means is separated from liquid crystal equipment, one polarization means 961R, 961G, and 961B are stuck on the prism unit 910, and the polarization means 960R, 960G, and 960B of another side can more specifically be stuck [formation and] on condenser lenses 953, 945, and 944. Thus, since the heat of a polarization means is absorbed in a prism unit by sticking a polarization means on a prism unit, the temperature rise of liquid crystal equipment can be prevented.
[0150] Moreover, since an air space is made by detaching and forming liquid crystal equipment, a polarization means, and between between liquid crystal equipment and a polarization means as shown in drawing 15 , From a cooling means for example, by sending in ventilation of cold blast etc. from the ventilation opening 990 between liquid crystal equipment and a polarization means by forming a cooling means in either a prism unit top or the bottom The temperature rise of liquid crystal equipment can be prevented further, and malfunction by the temperature rise of liquid crystal equipment can be prevented.
[0151] In drawing 16 , the personal computer 1200 of other example slack laptop types of electronic equipment is equipped with the body 1204 with which the keyboard 1202 was incorporated while it has liquid crystal equipment 200 mentioned above in the top covering case and it holds CPU, memory, a modem, etc. further.
[0152] In drawing 17 , the drive circuit 1004 of the above-mentioned [other example slack pagers 1300 of electronic equipment] in the metal frame 1302 is held in the light guide [in which the liquid crystal equipment 200 which is carried at a TFT array substrate top and forms a liquid crystal module contains back light 1306a] 1306, circuit board 1308, 1st, and 2nd shielding plates 1310 and 1312 or 2 elastic conductors 1314 and 1316, and a list with the tape carrier package tape 1318. In the case of this example, the above-mentioned display information processing circuit 1002 (refer to drawing 13) may be carried in the circuit board 1308, and may be carried on the TFT array substrate of liquid crystal equipment 200. Furthermore, it is also possible to carry the above-mentioned drive circuit 1004 on the circuit board 1308.
[0153] moreover, as shown in drawing 18 , in the case of the liquid crystal equipment 200 which carries neither the drive circuit 1004 nor the display information processing circuit 1002 To TCP (Tape Carrier Package)1320 mounted on the polyimide tape 1322, IC1324 including the drive circuit 1004 or the display information processing circuit 1002 It is also possible to connect physically and electrically through the anisotropy electric conduction film prepared in the periphery of the TFT array substrate 1, and to carry out production, sale, use, etc. as liquid crystal equipment.
[0154] ****** equipped with the video tape recorder of a liquid crystal television, a viewfinder mold, or a monitor direct viewing type, the car navigation equipment, the electronic notebook, the calculator, the word processor, the workstation, the cellular phone, the TV phone, POS terminal, and touch panel other than electronic equipment which were explained with reference to drawing 18 from drawing 14 above etc. is mentioned as an example of the electronic equipment shown in drawing 13 .
[0155] As explained above, according to the gestalt of this operation, the protection-from-light engine performance to return light etc. is high, and TFT with outstanding transistor characteristics can realize various kinds of electronic equipment equipped with the liquid crystal equipment in which high-definition image display is possible.
[0156]
[Effect of the Invention] Since the situation where originate in return light etc. in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, a photocurrent occurs, and a switching characteristic deteriorates is prevented beforehand according to this invention, high-definition image display becomes possible by the switching element with the outstanding switching characteristic. Furthermore, since there is no need of arranging a sampling circuit and a precharge circuit into the circumference part of the 1st substrate into which it was put by the case of protection-from-light nature like before, it also becomes possible, for example by arranging these circuits under circumference abandonment to use effectively dead

space called the bottom of circumference abandonment.
[0157] Moreover, since the situation where originate in return light etc., a photocurrent occurs in a semiconductor layer, and the transistor characteristics of TFT deteriorate is prevented beforehand, the high-definition image display of it becomes possible by TFT with outstanding transistor characteristics.

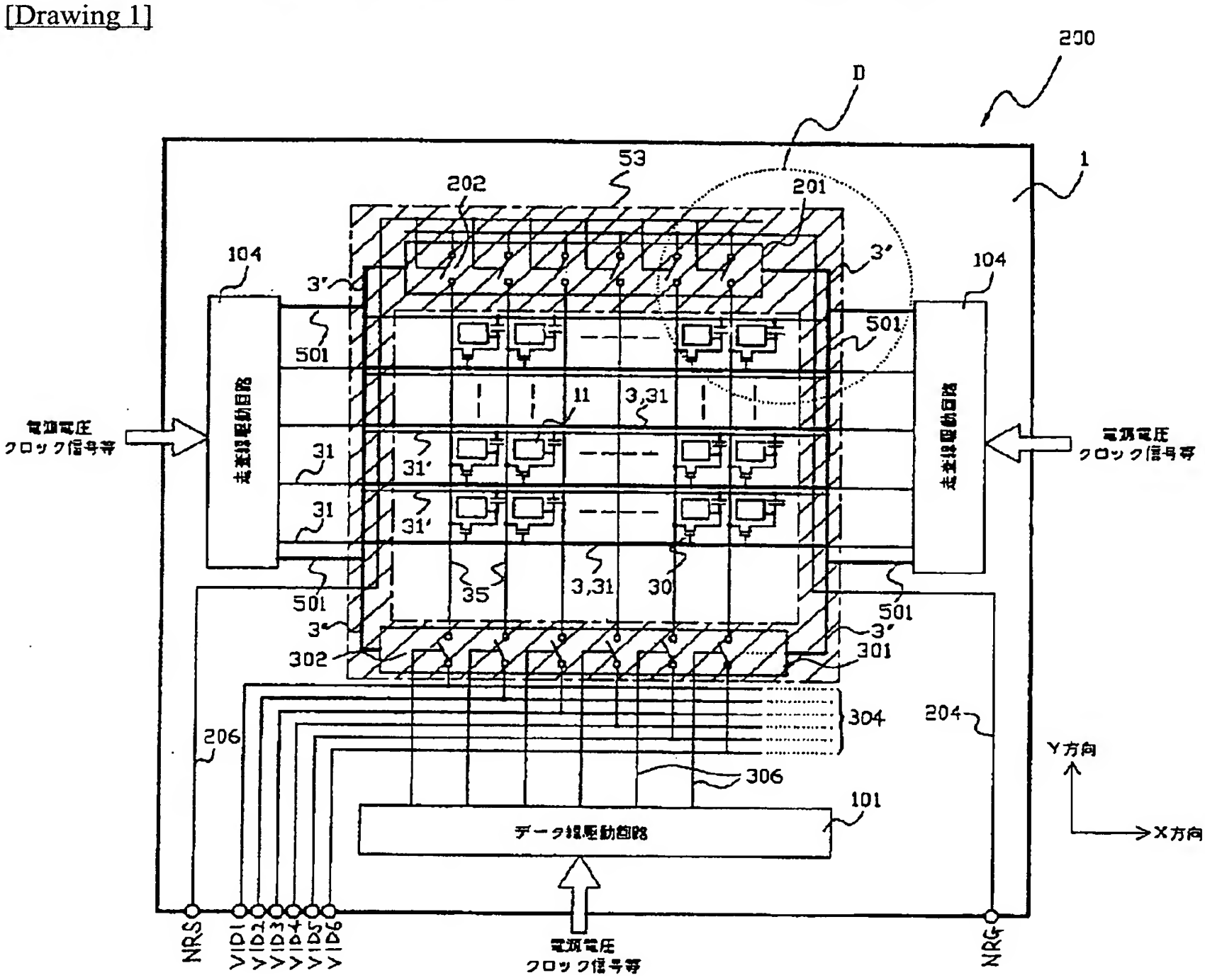
[Translation done.]

* NOTICES *

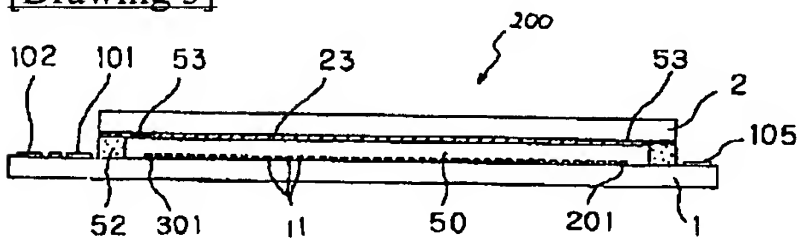
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

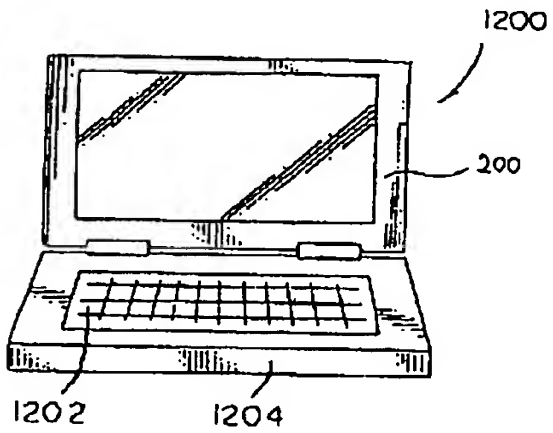
[Drawing 1]



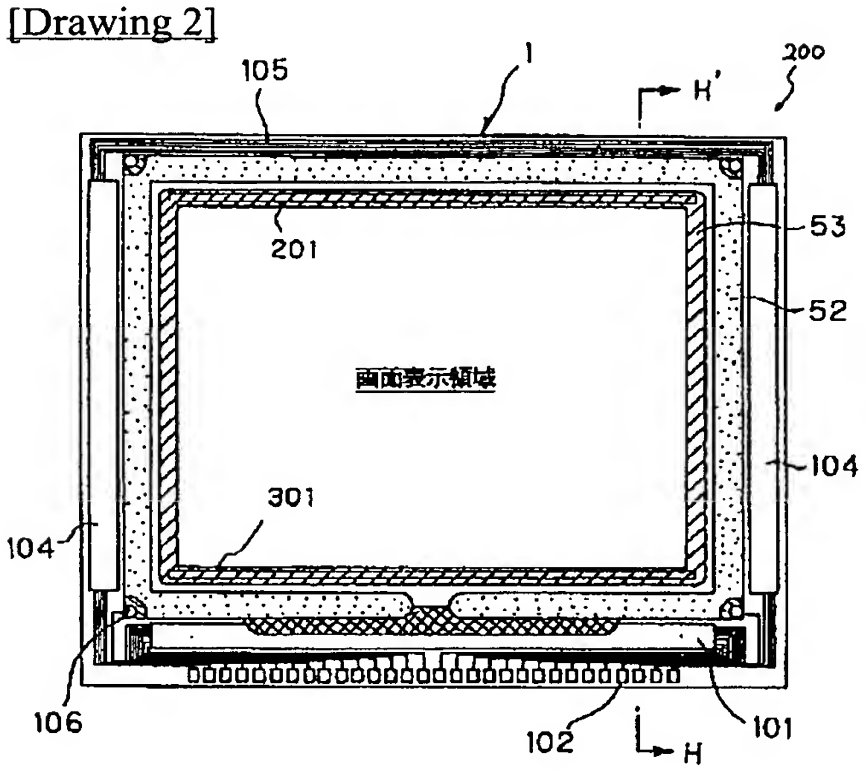
[Drawing 3]



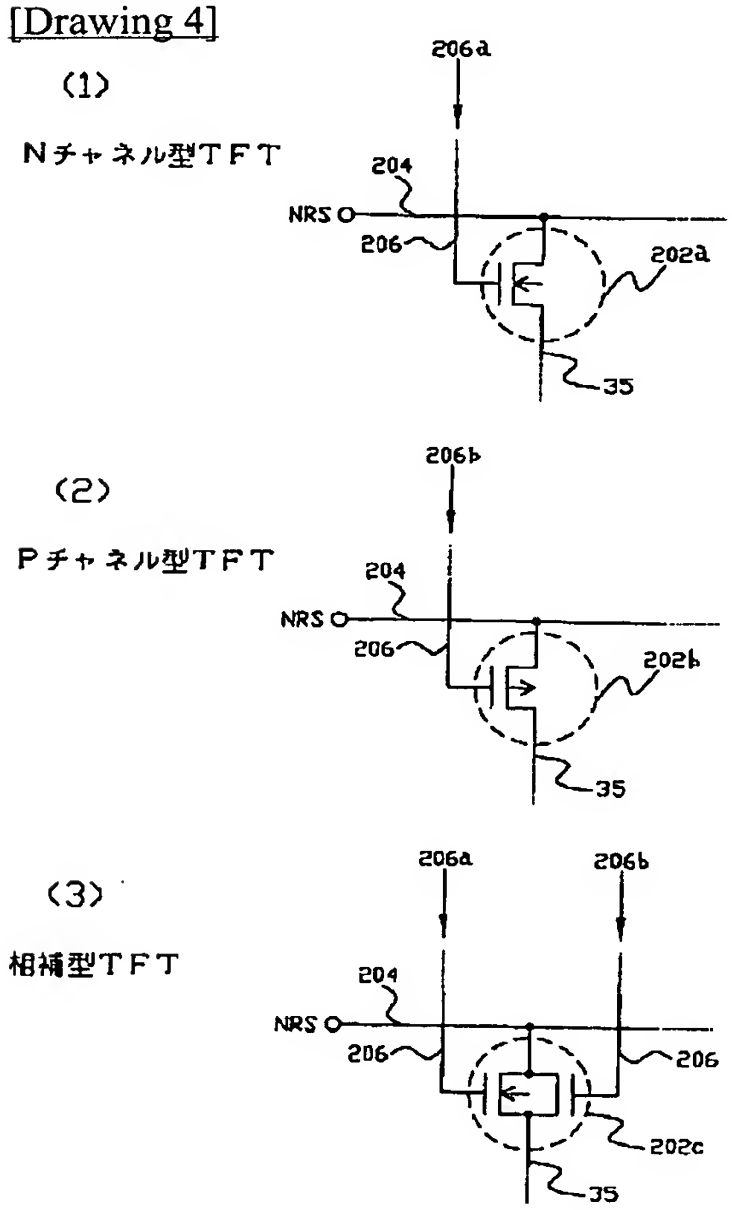
[Drawing 16]



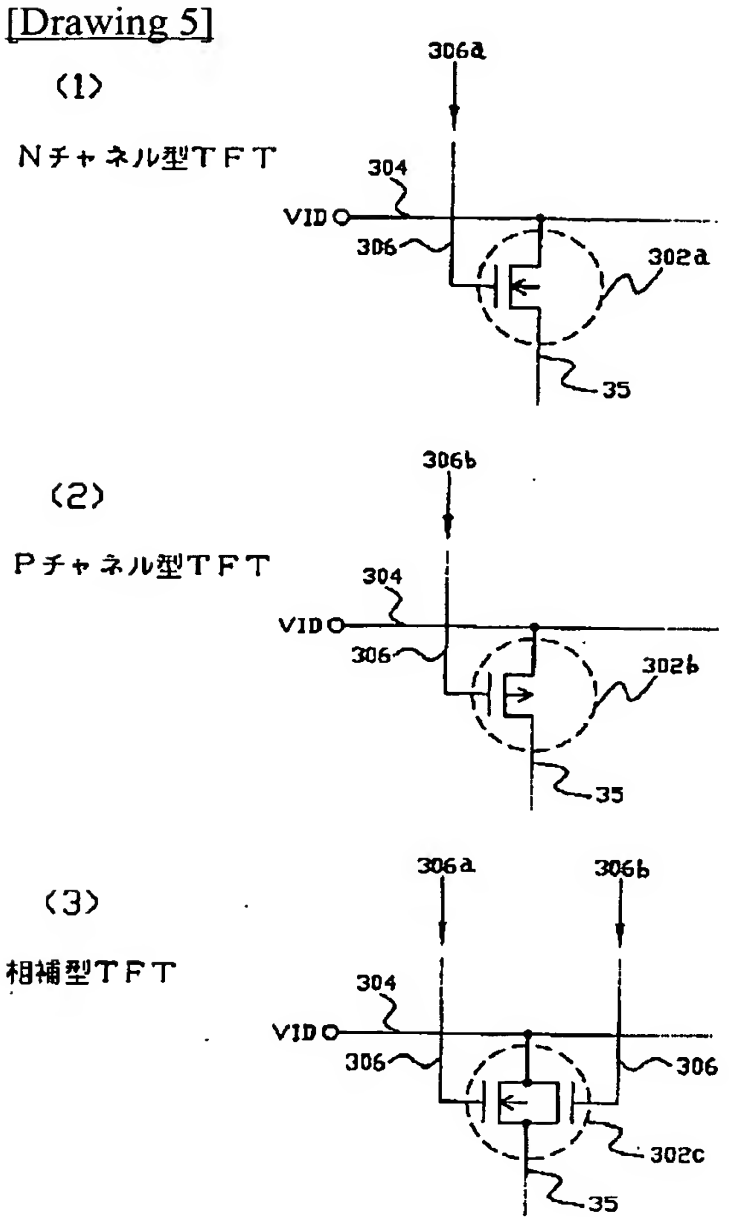
[Drawing 2]



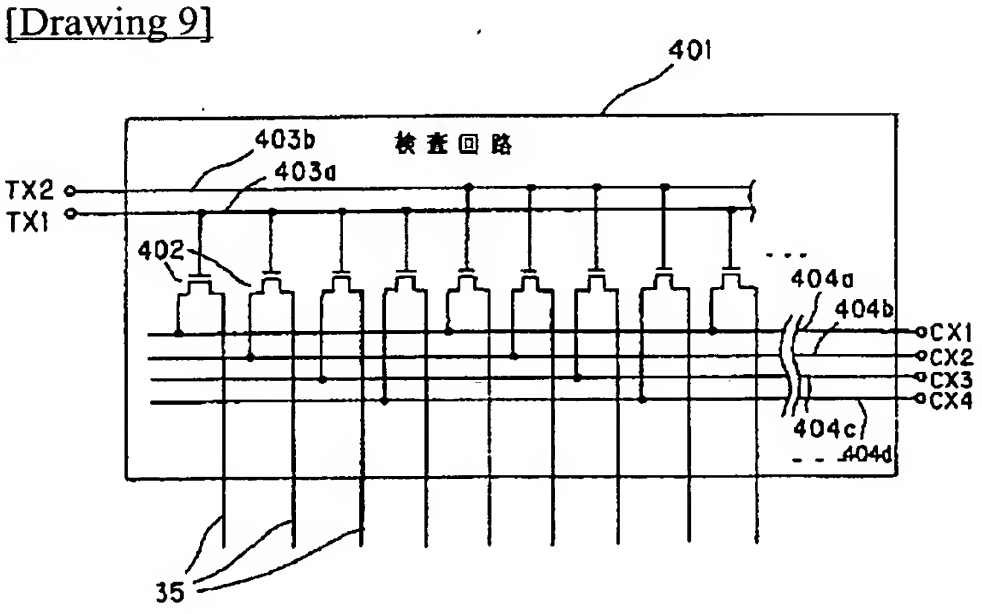
[Drawing 4]



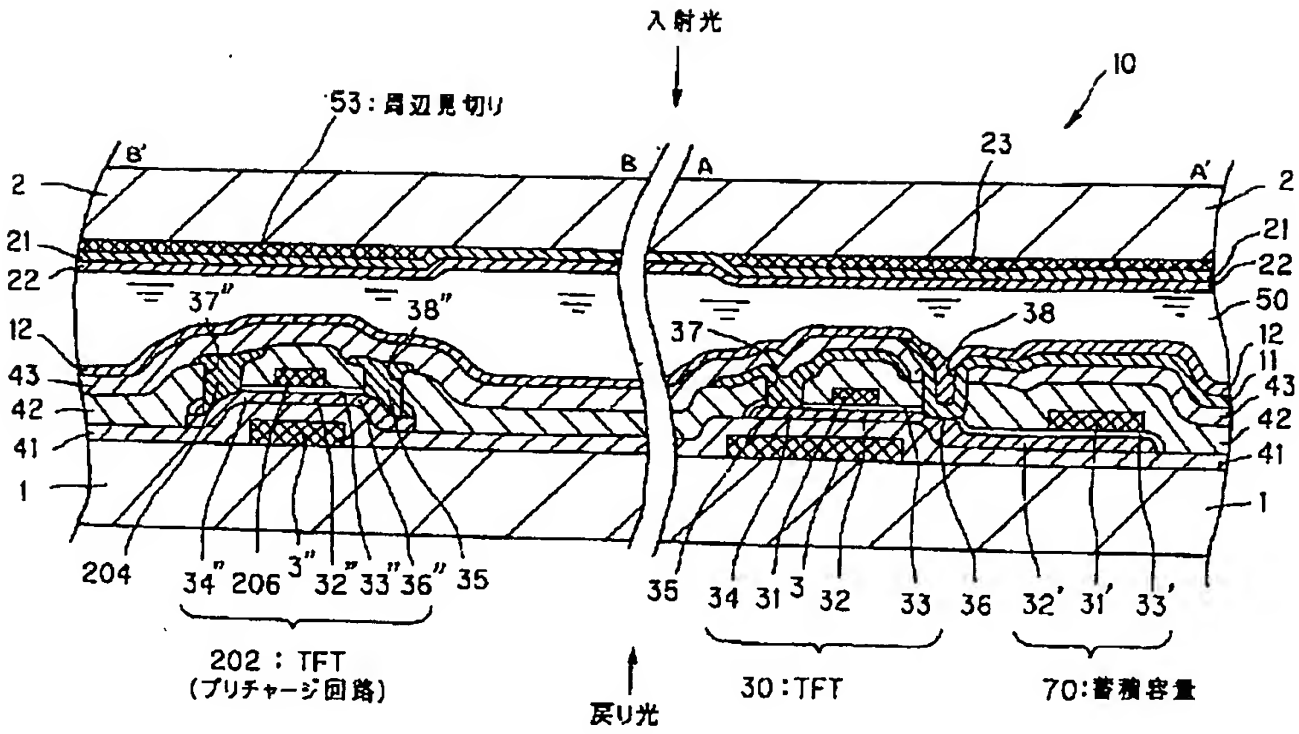
[Drawing 5]



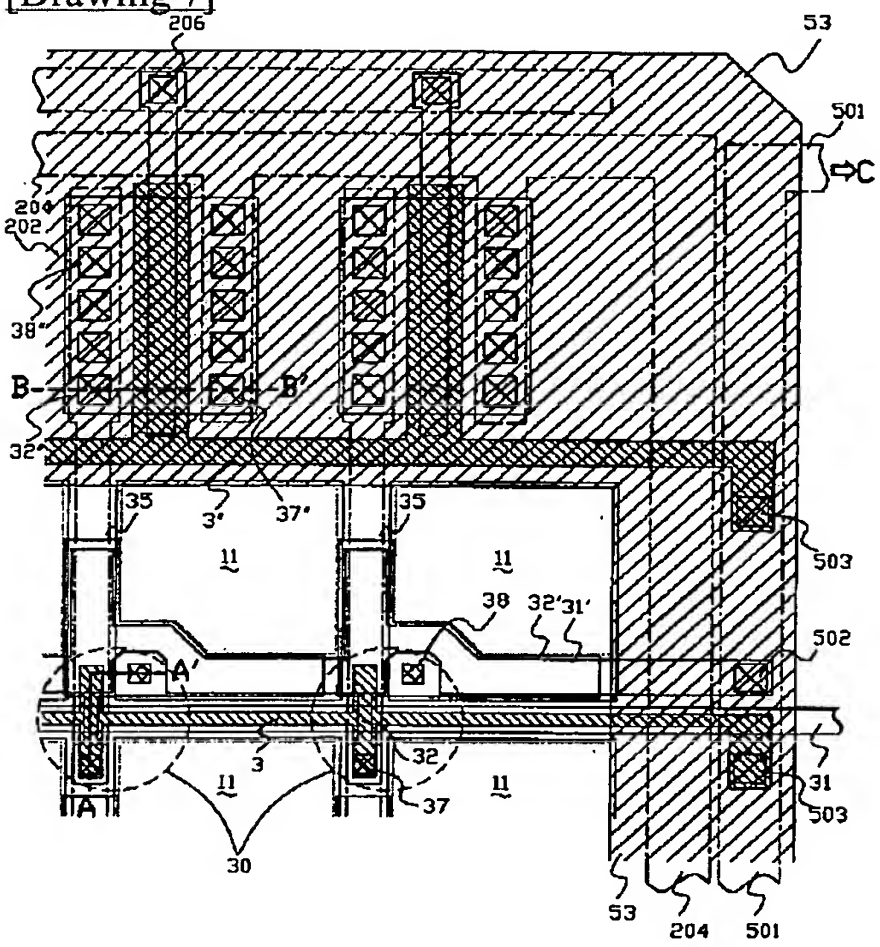
[Drawing 9]



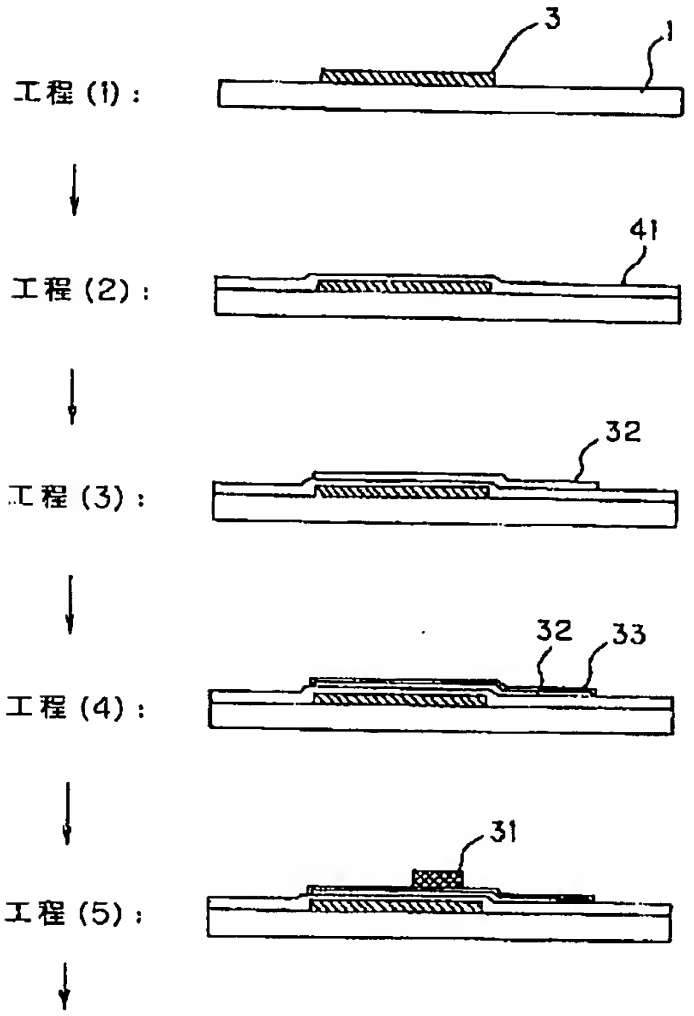
[Drawing 6]



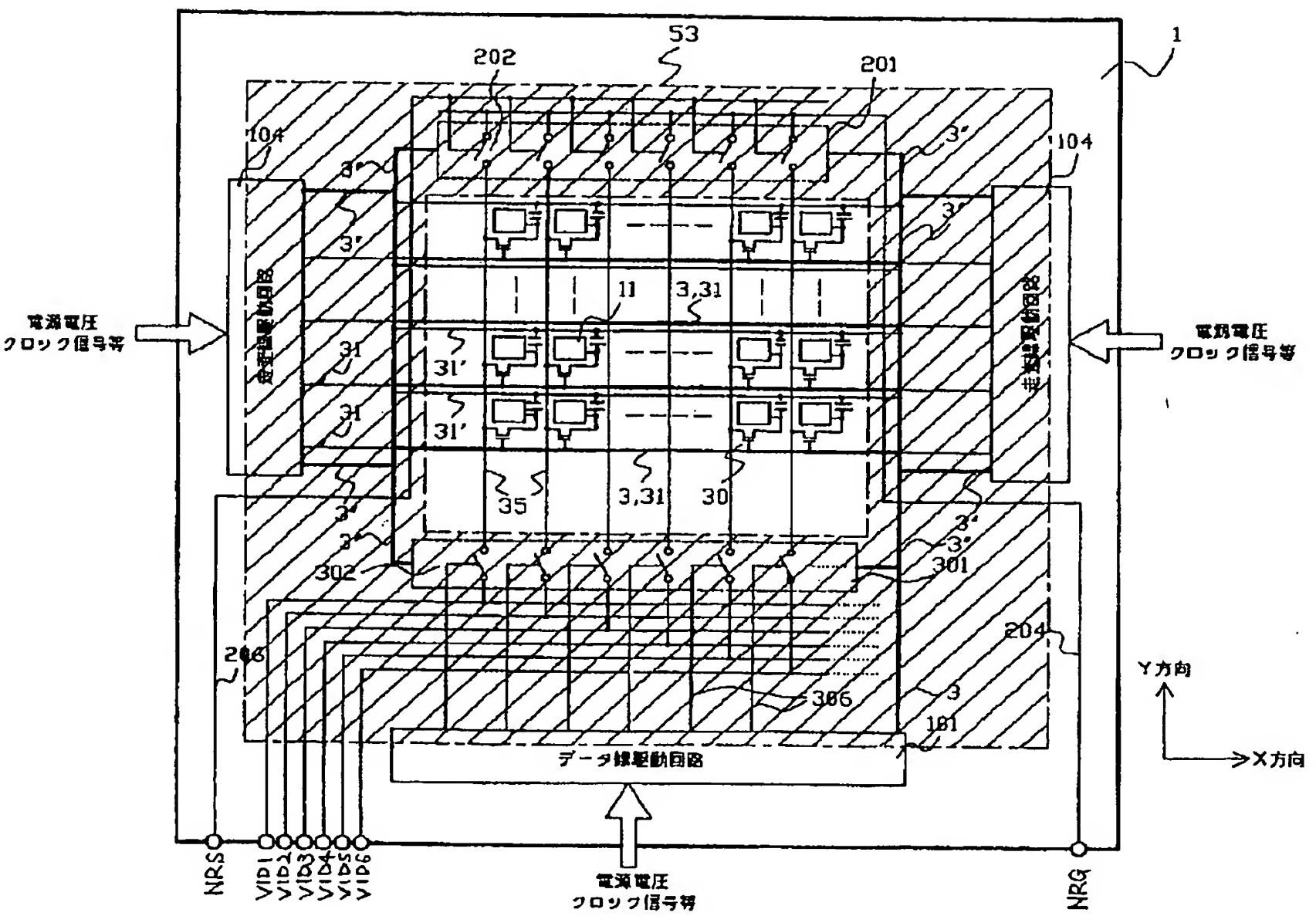
[Drawing 7]



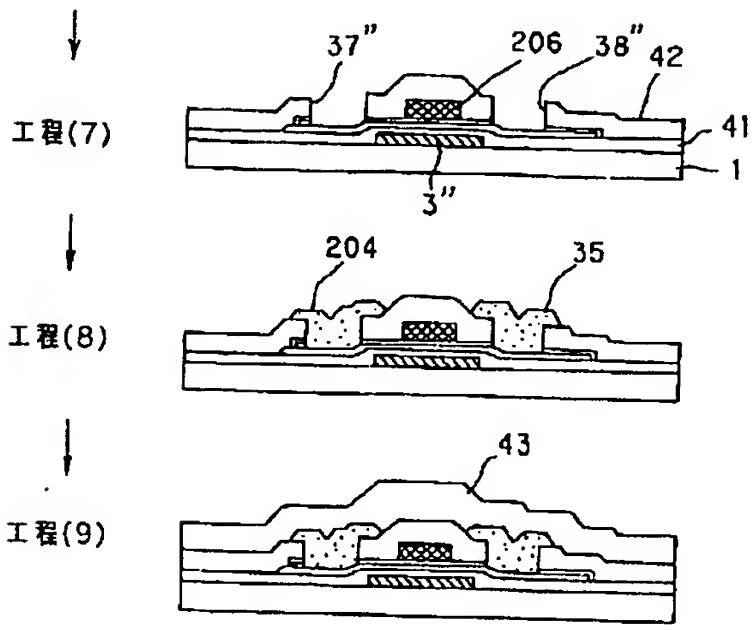
[Drawing 10]



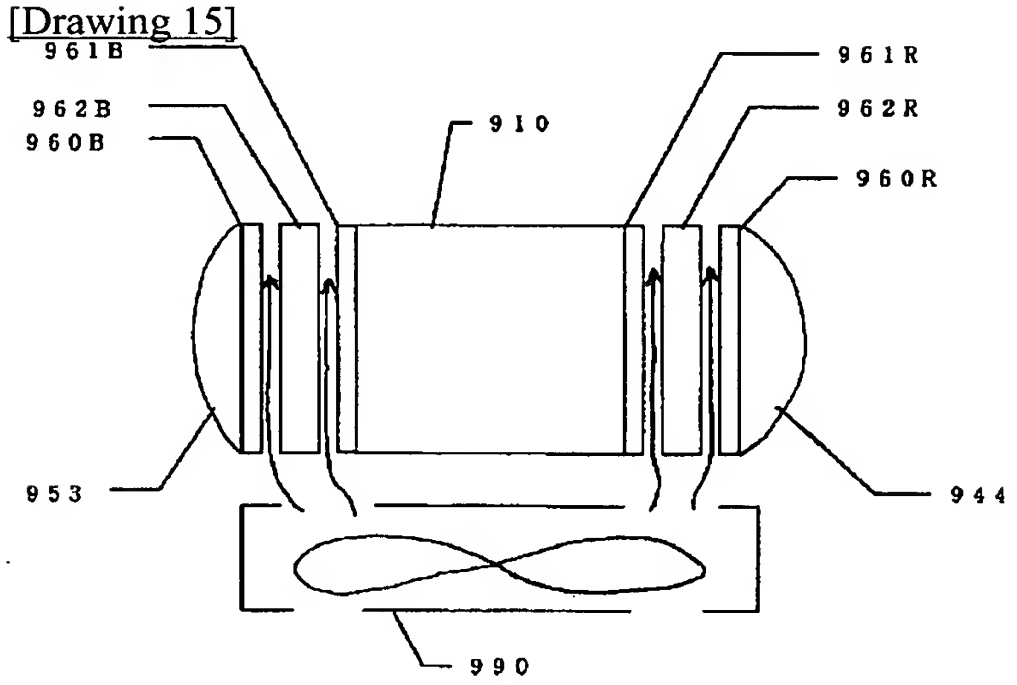
[Drawing 8]



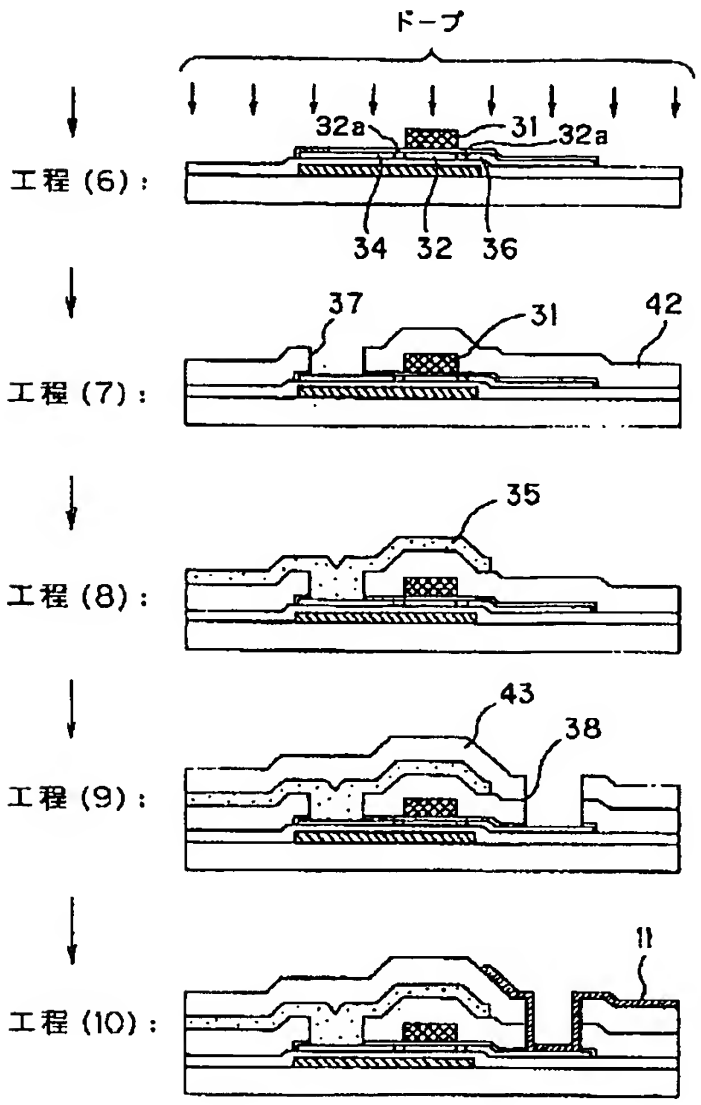
[Drawing 12]



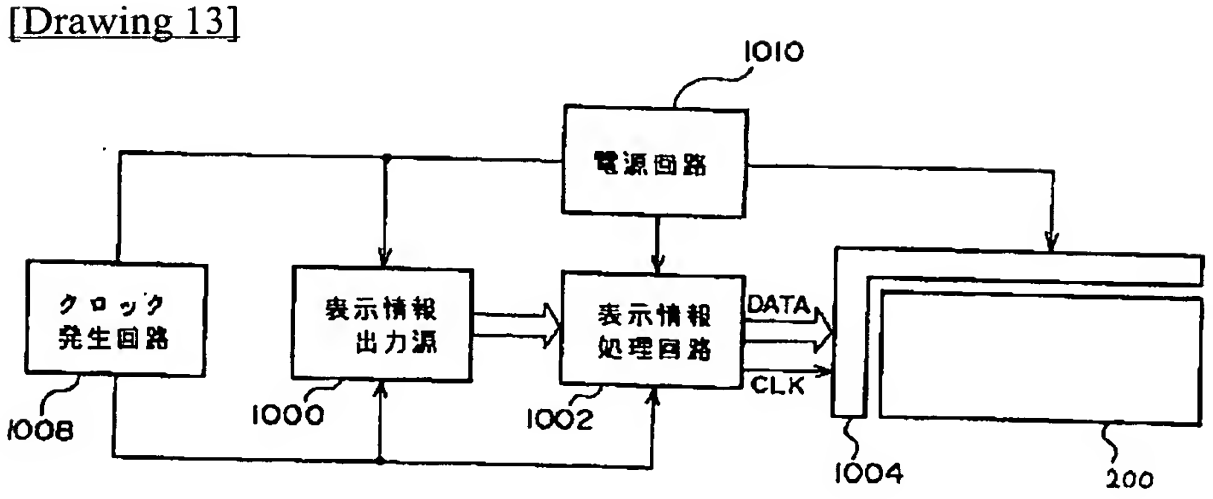
[Drawing 15]



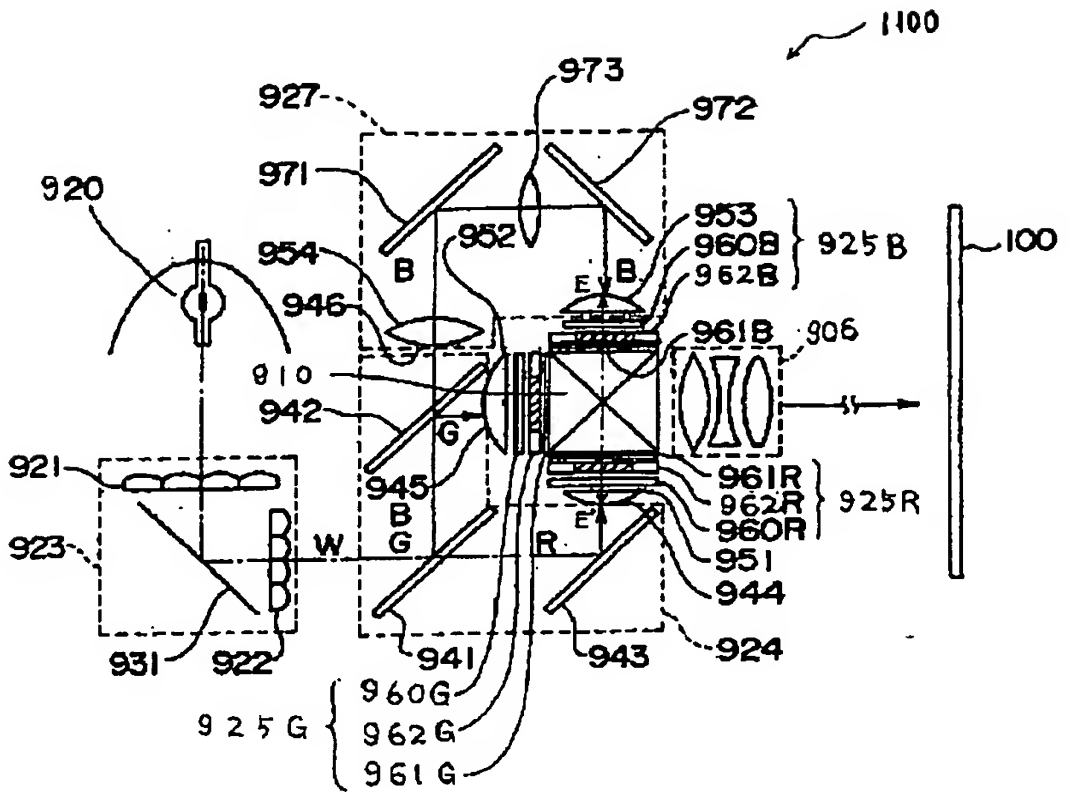
[Drawing 11]



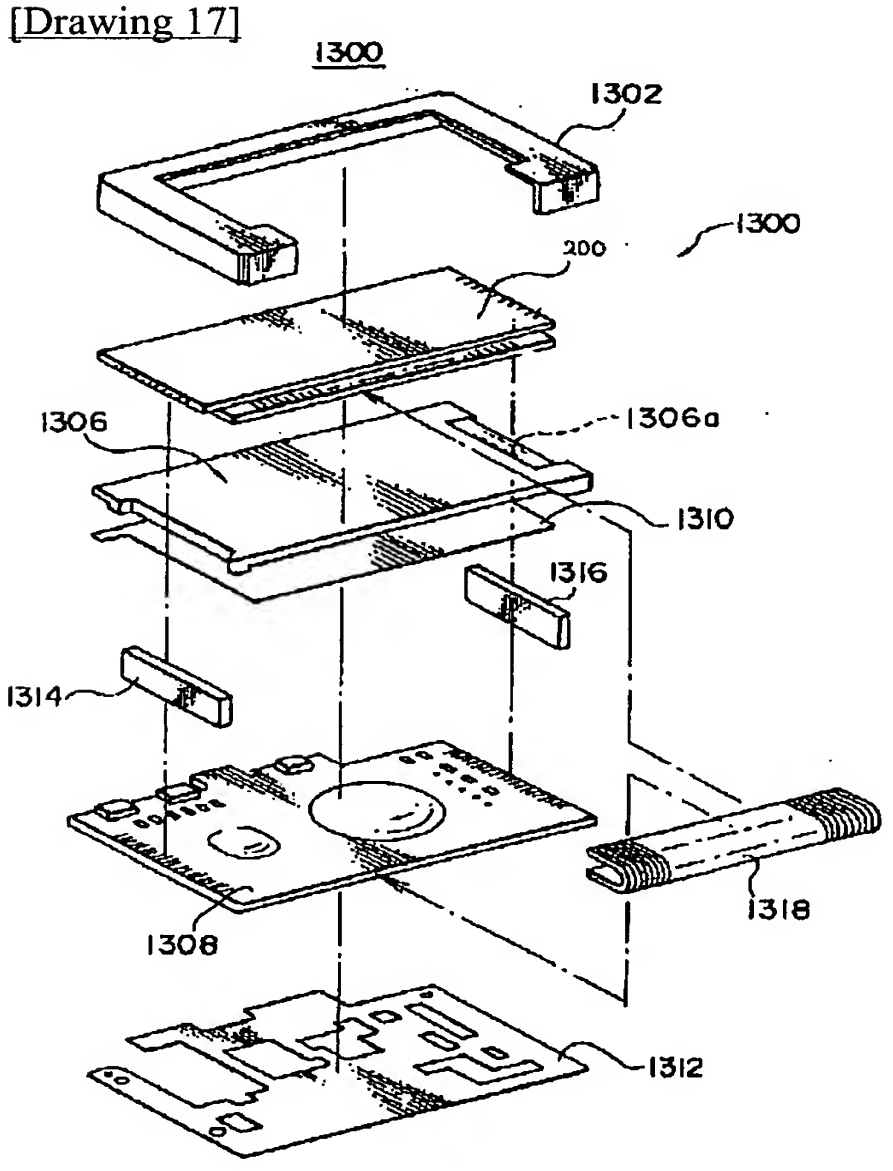
[Drawing 13]



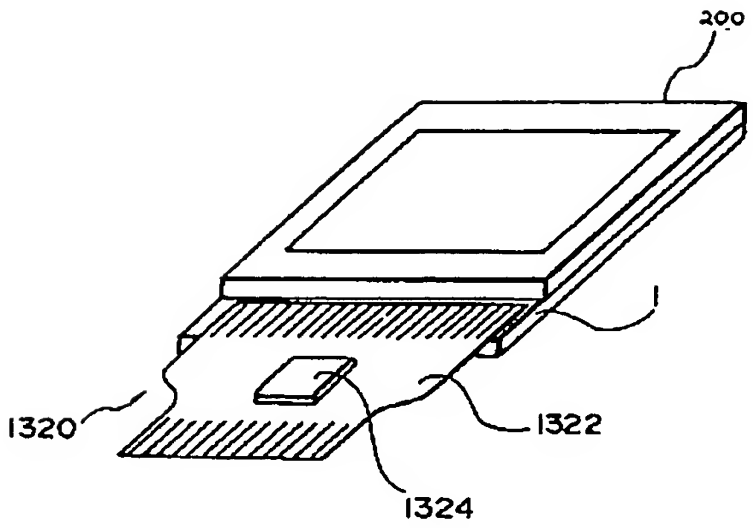
[Drawing 14]



[Drawing 17]



[Drawing 18]



[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] February 13, Heisei 15 (2003. 2.13)

[Publication No.] JP,11-194360,A
[Date of Publication] July 21, Heisei 11 (1999. 7.21)
[Annual volume number] Open patent official report 11-1944
[Application number] Japanese Patent Application No. 10-84661
[The 7th edition of International Patent Classification]

G02F 1/136 500

[FI]

G02F 1/136 500

[Procedure revision]
[Filing Date] November 7, Heisei 14 (2002. 11.7)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] It comes to pinch liquid crystal between the 1st and 2nd substrates of a pair, and has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st switching elements connected to two or more of said scanning lines and data lines, and said two or more 1st switching elements on said 1st substrate,
One [at least] circuit is arranged at said 1st substrate among the sampling circuit which samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, and the precharge circuit which precedes the precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and is supplied, respectively,
Liquid crystal equipment characterized by having further the protection-from-light layer prepared in said 1st switching element list in the location which counters one [at least] component of said 2nd and 3rd switching elements which one [said / at least] circuit has, respectively, respectively between said 1st substrate and said 1st switching element, and one [this] component.
[Claim 2] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment according to claim 1 characterized by including the semi-conductor layer which constitutes this thin film transistor that consisted of a thin film transistor and was formed through the insulator layer on said protection-from-light layer.
[Claim 3] It is liquid crystal equipment according to claim 1 or 2 which at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD (Lightly Doped Drain) structure, and is characterized by preparing said protection-from-light layer in the location which counters the channel field and LDD field of this thin film transistor at least.
[Claim 4] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-3

characterized by crossing to the whole region and being formed from the same ingredient by the same film formation process.
[Claim 5] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-4 characterized by connecting with the constant source of potential.
[Claim 6] The constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to touch-down potential.
[Claim 7] It has further the counterelectrode prepared in the side which meets said liquid crystal of said 2nd substrate,
The constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to the potential of said counterelectrode.
[Claim 8] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment given in any 1 term of claims 1-7 characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.
[Claim 9] The seal member which sticks said 1st and 2nd substrates in the perimeter of the screen-display field specified with said two or more pixel electrodes on a flat surface parallel to said 1st and 2nd substrates, and surrounds said liquid crystal,
It has further circumference abandonment of the protection-from-light nature formed along with the profile of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said flat surface,
One [said / at least] circuit is liquid crystal equipment given in any 1 term of claims 1-8 characterized by being prepared in the location which counters said circumference abandonment.
[Claim 10] Said precharge circuit is prepared,
Said two or more data lines are liquid crystal equipment given in any 1 term of claims 1-9 characterized by supplying said precharge signal from the other side while said picture signal is supplied from the one side of said data line.
[Claim 11] The inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal equipment concerned is further established in said 1st substrate,
Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-10 characterized by being further prepared between said 1st substrate and said 4th switching element in the location which counters said 4th switching element.
[Claim 12] In liquid crystal equipment according to claim 1,
It replaces with one [said / at least] circuit, and the circumference circuit containing the 5th switching element for the electrical-potential-difference maintenance for operating the liquid crystal equipment concerned is established in said 1st substrate,
Said protection-from-light layer is liquid crystal equipment characterized by being prepared between said 1st substrate and said 5th switching element in the location which counters said 5th switching element.
[Claim 13] Electronic equipment characterized by equipping either of claims 1-12 with the liquid crystal equipment of a publication.
[Claim 14] In the projection mold display which has the light source, the liquid crystal light valve which incidence of the light by which outgoing radiation is carried out from this light source is carried out, and performs the modulation corresponding to image information, and the delivery system which projects the light modulated with said liquid crystal light valve,
Said liquid crystal light valve has the liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at the 1st substrate [which has been arranged at the incidence side of light], and outgoing radiation side, the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate,
On said 2nd substrate, it has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, and said two or more 1st thin film transistors,

Even if there are few said 1st thin film transistors between said 2nd substrate and said 1st thin film transistor, corresponding to a channel field, it comes to arrange a protection-from-light layer then,
The projection mold display characterized by coming to form space between said 2nd polarization means and said liquid crystal equipment.
[Claim 15] In the projection mold display which has the light source, a color-separation means separate into the colored-light bundle of at least 2 colors the flux of light by which outgoing radiation is carried out from

this light source, the liquid-crystal light valve that perform the modulation corresponding to image information to the flux of light of each color separated by said color-separation means, a synthetic means compound the light modulated with said liquid-crystal light valve, and the delivery system which project the synthetic flux of light by which outgoing radiation was carried out from said synthetic means,
Said liquid crystal light valve has the liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at the 1st substrate [which has been arranged at the incidence side of light], and outgoing radiation side of light, the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate,
On said 2nd substrate, it has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, and said two or more 1st thin film transistors,

Even if there are few said 1st thin film transistors between said 2nd substrate and said 1st thin film transistor, corresponding to a channel field, it comes to arrange a protection-from-light layer then,
Said 2nd polarization means is a projection mold display characterized by being stuck on said synthetic means.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012]
[Means for Solving the Problem] In order that the liquid crystal equipment of this invention may solve the above-mentioned technical problem, it comes to pinch liquid crystal between the 1st and 2nd substrates of a pair. On said 1st substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st switching elements connected to two or more of said scanning lines and data lines, The sampling circuit which has two or more pixel electrodes connected to said two or more 1st switching elements, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among the precharge circuits which precede the precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In the location which counters one [at least] component of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively It is characterized by having further the protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] component.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0013
[Method of Amendment] Modification
[Proposed Amendment]
[0013] According to the liquid crystal equipment of this invention, a sampling circuit samples a picture signal by two or more 2nd switching elements which consist of TFT etc., and supplies it to two or more data lines. A precharge circuit precedes the precharge signal of a predetermined voltage level with a picture signal by two or more 3rd switching elements which consist of TFT etc. at two or more data lines, and supplies it, respectively. One [at least] circuit is established in the 1st substrate among these sampling circuits and precharge circuits. Here, the protection-from-light layer is prepared in the location which counters one [at least] component of the 2nd and 3rd switching elements which one circuit has, respectively even if this ** cannot be found in the 1st switching element list between the 1st substrate, the 1st switching element, and one [this] component, respectively. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effectiveness in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, and a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about a sampling circuit or a precharge circuit is given, the need of arranging these circuits into the circumference part of the 1st substrate

into which it was put by the case of protection-from-light nature like before is lost. For example, these circuits can also be arranged to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0014
[Method of Amendment] Modification
[Proposed Amendment]
[0014] Moreover, it is characterized by the liquid crystal equipment of this invention containing the semi-conductor layer which constitutes this thin film transistor that at least one of said 1st, 2nd, and 3rd switching elements consisted of a thin film transistor, and was formed through the insulator layer on said protection-from-light layer.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0015
[Method of Amendment] Modification
[Proposed Amendment]
[0015] According to the liquid crystal equipment of this invention, among the 1st, 2nd, and 3rd switching elements at least one Although the semi-conductor layer which constitutes the thin film transistor (TFT) formed through the insulator layer on the protection-from-light layer is included, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this semi-conductor layer, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this semi-conductor layer, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0016
[Method of Amendment] Modification
[Proposed Amendment]
[0016] Moreover, in the liquid crystal equipment of this invention, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD structure, and it is characterized by preparing said protection-from-light layer in the location which counters the channel field and LDD field of this thin film transistor at least.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0017
[Method of Amendment] Modification
[Proposed Amendment]
[0017] According to the liquid crystal equipment of this invention, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of LDD structure, but Since the protection-from-light layer is prepared in the location which counters this channel field of TFT, and a LDD field at least Even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this channel field and a LDD field, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these. For this reason, in this channel field and a LDD field, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0018
[Method of Amendment] Modification
[Proposed Amendment]
[0018] Moreover, the liquid crystal equipment of this invention is characterized by crossing said protection-from-light layer to the whole region, and forming it from the same ingredient by the same film formation process.
[Procedure amendment 9]

[Document to be Amended] Specification
[Item(s) to be Amended] 0019
[Method of Amendment] Modification
[Proposed Amendment]
[0019] According to the liquid crystal equipment of this invention, although the protection-from-light layer is prepared to various kinds of switching elements, it goes across a protection-from-light layer throughout the, and it is formed from the same ingredient by the same film formation process. That is, it becomes possible to form the protection-from-light layer to various kinds of switching elements according to the same process in the production process of the liquid crystal equipment concerned in this case.
[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0020
[Method of Amendment] Modification
[Proposed Amendment]
[0020] Moreover, the liquid crystal equipment of this invention is characterized by connecting said protection-from-light layer to the constant source of potential.
[Procedure amendment 11]
[Document to be Amended] Specification
[Item(s) to be Amended] 0021
[Method of Amendment] Modification
[Proposed Amendment]
[0021] According to the liquid crystal equipment of this invention, since the protection-from-light layer is connected to the constant source of potential, let a protection-from-light layer be constant potential. Therefore, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[Procedure amendment 12]
[Document to be Amended] Specification
[Item(s) to be Amended] 0022
[Method of Amendment] Modification
[Proposed Amendment]
[0022] Moreover, the liquid crystal equipment of this invention is characterized by the constant potential of said constant source of potential being equal to touch-down potential.
[Procedure amendment 13]
[Document to be Amended] Specification
[Item(s) to be Amended] 0023
[Method of Amendment] Modification
[Proposed Amendment]
[0023] According to the liquid crystal equipment of this invention, since a protection-from-light layer is made into touch-down potential, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[Procedure amendment 14]
[Document to be Amended] Specification
[Item(s) to be Amended] 0024
[Method of Amendment] Modification
[Proposed Amendment]
[0024] Moreover, the liquid crystal equipment of this invention is further equipped with the counterelectrode prepared in the side which meets said liquid crystal of said 2nd substrate, and constant potential of said constant source of potential is characterized by being equal to the potential of said counterelectrode.
[Procedure amendment 15]
[Document to be Amended] Specification
[Item(s) to be Amended] 0025
[Method of Amendment] Modification
[Proposed Amendment]

[0025] According to the liquid crystal equipment of this invention, since a protection-from-light layer is made into the potential of a counterelectrode, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.
[Procedure amendment 16]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Modification
[Proposed Amendment]
[0026] Moreover, the liquid crystal equipment of this invention is characterized by at least one of said 1st, 2nd, and 3rd switching elements consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.
[Procedure amendment 17]
[Document to be Amended] Specification
[Item(s) to be Amended] 0027
[Method of Amendment] Modification
[Proposed Amendment]
[0027] According to the liquid crystal equipment of this invention, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of any one mold in an N channel mold, a P channel mold, and a complementary type, but Since the protection-from-light layer is prepared in this location that counters TFT at least, even if return light etc. carries out incidence from the 1st substrate side, before [this] carrying out incidence to TFT, this return light etc. will be shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this TFT, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.
[Procedure amendment 18]
[Document to be Amended] Specification
[Item(s) to be Amended] 0028
[Method of Amendment] Modification
[Proposed Amendment]
[0028] Moreover, the seal member which the liquid crystal equipment of this invention sticks said 1st and 2nd substrates in the perimeter of the screen-display field specified with said two or more pixel electrodes on a flat surface parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of the protection-from-light nature formed along with the profile of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said flat surface, and one [said / at least] circuit is characterized by being prepared in the location which counters said circumference abandonment.
[Procedure amendment 19]
[Document to be Amended] Specification
[Item(s) to be Amended] 0029
[Method of Amendment] Modification
[Proposed Amendment]
[0029] According to the liquid crystal equipment of this invention, circumference abandonment of protection-from-light nature is formed along with the profile of a screen-display field at the 2nd substrate between the seal members and screen-display fields which surround liquid crystal. Here, among a sampling circuit and a precharge circuit, since one [at least] circuit is established in the location which counters circumference abandonment, if it is called circumference abandonment and says, a deployment of dead space can be aimed at. In this case, before carrying out incidence to the switching element which these sampling circuits and precharge circuits have even if incident light etc. carries out incidence from the 2nd substrate side since especially circumference abandonment is protection-from-light nature, this incident light etc. is shaded by circumference abandonment. Therefore, it originates in incident light etc. and there is no un-arranging [for which a photocurrent occurs according to the photo-electric-conversion effectiveness in a switching element, and a switching characteristic deteriorates]. Thus, if a sampling circuit and a precharge circuit are arranged in the location which counters circumference abandonment, since it is not necessary to give protection from light to the light from the 2nd substrate side, it is very advantageous.
[Procedure amendment 20]

[Document to be Amended] Specification
[Item(s) to be Amended] 0030
[Method of Amendment] Modification
[Proposed Amendment]
[0030] Moreover, said two or more data lines are characterized by supplying said precharge signal from the other side while, as for the liquid crystal equipment of this invention, said precharge circuit is prepared and said picture signal is supplied from the one side of said data line.
[Procedure amendment 21]
[Document to be Amended] Specification
[Item(s) to be Amended] 0031
[Method of Amendment] Modification
[Proposed Amendment]
[0031] According to the liquid crystal equipment of this invention, a picture signal is supplied from the one side of said data line, and, as for two or more data lines, a precharge signal is supplied from the other side of said data line. Therefore, a precharge circuit can be established in an opposite side across the data-line drive circuit, sampling circuit, etc. and screen-display field for supplying a picture signal.
[Procedure amendment 22]
[Document to be Amended] Specification
[Item(s) to be Amended] 0032
[Method of Amendment] Modification
[Proposed Amendment]
[0032] Moreover, it is characterized by establishing further the inspection circuit containing the 4th switching element for the liquid crystal equipment of this invention conducting predetermined inspection to the liquid crystal equipment concerned in said 1st substrate, and preparing said protection-from-light layer further between said 1st substrate and said 4th switching element in the location which counters said 4th switching element.
[Procedure amendment 23]
[Document to be Amended] Specification
[Item(s) to be Amended] 0033
[Method of Amendment] Modification
[Proposed Amendment]
[0033] According to the liquid crystal equipment of this invention, the protection-from-light layer is prepared in the location which counters the 4th switching element which an inspection circuit has between the 1st substrate and this 4th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 4th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, in the 4th switching element which consists of TFT etc., for example, a photocurrent occurs according to the photo-electric-conversion effectiveness, and the situation where a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about an inspection circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.
[Procedure amendment 24]
[Document to be Amended] Specification
[Item(s) to be Amended] 0034
[Method of Amendment] Modification
[Proposed Amendment]
[0034] Moreover, it is characterized by replacing the liquid crystal equipment of this invention with one [said / at least] circuit, establishing the circumference circuit containing the 5th switching element for the electrical-potential-difference maintenance for operating the liquid crystal equipment concerned in said 1st substrate, and preparing said protection-from-light layer between said 1st substrate and said 5th switching element in the location which counters said 5th switching element.
[Procedure amendment 25]
[Document to be Amended] Specification
[Item(s) to be Amended] 0035
[Method of Amendment] Modification
[Proposed Amendment]

[0035] According to the liquid crystal equipment of this invention, the protection-from-light layer is prepared in the location which counters the 5th switching element which a circumference circuit has between the 1st substrate and this 5th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 5th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effectiveness in the 5th switching element which consists of TFT etc., for example, a switching characteristic deteriorates, and a maintenance electrical potential difference changes is prevented beforehand. Furthermore, in this way, since protection from light about a circumference circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.
[Procedure amendment 26]
[Document to be Amended] Specification
[Item(s) to be Amended] 0036
[Method of Amendment] Modification
[Proposed Amendment]
[0036] It is characterized by equipping the electronic equipment of this invention with the liquid crystal equipment of the above-mentioned publication.
[Procedure amendment 27]
[Document to be Amended] Specification
[Item(s) to be Amended] 0037
[Method of Amendment] Modification
[Proposed Amendment]
[0037] According to the electronic equipment of this invention, electronic equipment is equipped with the liquid crystal equipment of the invention in this application mentioned above, and since various kinds of actuation is performed by the switching element in which the protection-from-light engine performance to return light etc. has the highly excellent switching characteristic, the high-definition image display of it becomes possible.
[Procedure amendment 28]
[Document to be Amended] Specification
[Item(s) to be Amended] 0038
[Method of Amendment] Modification
[Proposed Amendment]
[0038] The liquid crystal light valve with which incidence of the light to which outgoing radiation of the projection mold display of this invention is carried out from the light source and this light source is carried out, and it performs the modulation corresponding to image information, In the projection mold indicating equipment which has the delivery system which projects the light modulated with said liquid crystal light valve said liquid crystal light valve The liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at the 1st substrate [which has been arranged at the incidence side of light], and outgoing radiation side, It consists of the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment.
[Procedure amendment 29]
[Document to be Amended] Specification
[Item(s) to be Amended] 0039
[Method of Amendment] Modification
[Proposed Amendment]
[0039] According to the projection mold indicating equipment of this invention, the leakage current by return light can be prevented by forming a protection-from-light layer between the 2nd substrate and the 1st thin film transistor. Moreover, since the effect on the liquid crystal light valve by return light can be prevented, it is not necessary to stick a polarization means with an antireflection film on liquid crystal

equipment like before. therefore -- without it sticks the 2nd polarization means on liquid crystal equipment -- alienation -- since it can form, the temperature rise of a liquid crystal light valve can be prevented.
[Procedure amendment 30]
[Document to be Amended] Specification
[Item(s) to be Amended] 0040
[Method of Amendment] Modification
[Proposed Amendment]
[0040] Moreover, a color separation means by which the projection mold display of this invention separates into the colored light bundle of at least 2 colors the flux of light by which outgoing radiation is carried out from the light source and this light source, The liquid crystal light valve which performs the modulation corresponding to image information to the flux of light of each color separated by said color separation means, In the projection mold display which has a synthetic means to compound the light modulated with said liquid crystal light valve, and the delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means The liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at the 1st substrate [with which said liquid crystal light valve has been arranged at the incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means.
[Procedure amendment 31]
[Document to be Amended] Specification
[Item(s) to be Amended] 0041
[Method of Amendment] Modification
[Proposed Amendment]
[0041] According to the projection mold display of this invention, since the 2nd polarization means is stuck on the synthetic means, space is formed between liquid crystal equipment and the 2nd polarization means. Therefore, the temperature rise of liquid crystal equipment can be avoided and malfunction of a liquid crystal light valve can be prevented.
[Procedure amendment 32]
[Document to be Amended] Specification
[Item(s) to be Amended] 0042
[Method of Amendment] Modification
[Proposed Amendment]
[0042] As for the projection mold display of this invention, said synthetic means may consist of a prism unit.
[Procedure amendment 33]
[Document to be Amended] Specification
[Item(s) to be Amended] 0043
[Method of Amendment] Modification
[Proposed Amendment]
[0043] According to this projection mold display, said synthetic means consists of a prism unit, and the 2nd polarization means is stuck on the prism unit. The prism unit is effective in order to be able to absorb the heat capacity of the 2nd polarization means in a prism unit since heat capacity is large, and to prevent the temperature rise of a liquid crystal light valve.
[Procedure amendment 34]
[Document to be Amended] Specification
[Item(s) to be Amended] 0044
[Method of Amendment] Modification
[Proposed Amendment]
[0044] Moreover, the projection mold display of this invention is good to have further a cooling means to send cold blast between said liquid crystal equipment and said 2nd polarization means.

[Procedure amendment 35]
[Document to be Amended] Specification
[Item(s) to be Amended] 0045
[Method of Amendment] Modification
[Proposed Amendment]
[0045] According to this projection mold display, by forming a cooling means, for example in either a synthetic means top or the bottom, and sending cold blast between liquid crystal equipment and a polarization means from a cooling means, the temperature rise of a liquid crystal light valve can be prevented further, and malfunction of a liquid crystal light valve can be prevented.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平11－194360

(43)公開日　平成11年(1999)７月21日

(51)Int.Cl.[6]	識別記号	ＦＩ
Ｇ０２Ｆ　1/136	５００	Ｇ０２Ｆ　1/136　５００

審査請求　未請求　請求項の数17　ＯＬ　（全 25 頁）

(21)出願番号　特願平10－84661

(22)出願日　平成10年(1998)３月30日

(31)優先権主張番号　特願平9－301250

(32)優先日　平９(1997)10月31日

(33)優先権主張国　日本（ＪＰ）

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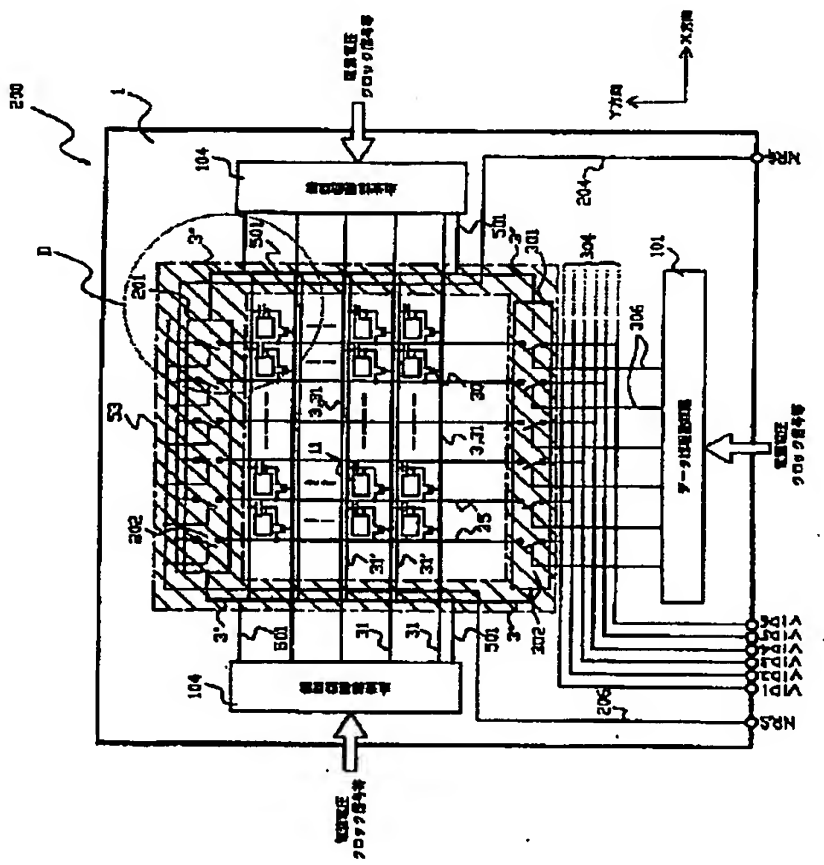
(54)【発明の名称】　液晶装置及び電子機器並びに投射型表示装置

(57)【要約】

【課題】　アクティブマトリクス駆動方式の液晶装置において、プリチャージ回路、サンプリング回路等が有するＴＦＴの下側からの戻り光等に対する遮光性能を高め、優れたスイッチング特性により高品質の画像表示を行う。

【解決手段】　液晶装置（２００）は、一対の基板間に挟持された液晶層（５０）と、基板にマトリクス状に設けられた画素電極（１１）と、これをスイッチング制御するＴＦＴ（３０）とを備える。このＴＦＴや、プリチャージ回路（２０１）及びサンプリング回路（３０１）のＴＦＴの下側には、遮光層が設けられている。



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【特許請求の範囲】

【請求項１】　一対の第１及び第２基板との間に液晶が挟持されてなり、

前記第１基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１スイッチング素子と、前記複数の第１スイッチング素子に接続された複数の画素電極とを有し、

複数の第２スイッチング素子により画像信号をサンプリングして前記複数のデータ線に供給するサンプリング回路と、複数の第３スイッチング素子により前記複数のデータ線に所定電圧レベルのプリチャージ信号を前記画像信号に先行して夫々供給するプリチャージ回路とのうち少なくとも一方の回路が前記第１基板に配置されており、

前記第１スイッチング素子並びに前記少なくとも一方の回路が有する前記第２及び第３スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置において、前記第１基板と前記第１スイッチング素子及び該一方の素子との間に夫々設けられた遮光層を更に備えたことを特徴とする液晶装置。

【請求項２】　前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、薄膜トランジスタからなり、前記遮光層上に絶縁膜を介して形成された該薄膜トランジスタを構成する半導体層を含むことを特徴とする請求項１に記載の液晶装置。

【請求項３】　前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、ＬＤＤ（Lightly　Doped Drain）構造の薄膜トランジスタからなり、前記遮光層は少なくとも該薄膜トランジスタのチャネル領域及びＬＤＤ領域に対向する位置に設けられていることを特徴とする請求項１又は２に記載の液晶装置。

【請求項４】　前記遮光層は全域に渡って同一の薄膜形成工程により同一材料から形成されていることを特徴とする請求項１から３のいずれか一項に記載の液晶装置。

【請求項５】　前記遮光層は、定電位源に接続されていることを特徴とする請求項１から４のいずれか一項に記載の液晶装置。

【請求項６】　前記定電位源の定電位は、接地電位に等しいことを特徴とする請求項５に記載の液晶装置。

【請求項７】　前記第２基板の前記液晶に対面する側に設けられた対向電極を更に備えており、

前記定電位源の定電位は、前記対向電極の電位に等しいことを特徴とする請求項５に記載の液晶装置。

【請求項８】　前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、Ｎチャネル型、Ｐチャネル型及び相補型のうちのいずれか一つの型の薄膜トランジスタからなることを特徴とする請求項１から７のいずれか一項に記載の液晶装置。

【請求項９】　前記第１及び第２基板に平行な平面上で

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前記複数の画素電極により規定される画面表示領域の周囲において前記第１及び第２基板を貼り合わせて前記液晶を包囲するシール部材と、

前記平面上で前記シール部材と前記画面表示領域との間において前記画面表示領域の輪郭に沿って前記第２基板に形成された遮光性の周辺見切りとを更に備えており、

前記少なくとも一方の回路は、前記周辺見切りに対向する位置に設けられたことを特徴とする請求項１から８のいずれか一項に記載の液晶装置。

【請求項１０】　前記プリチャージ回路が設けられており、

前記複数のデータ線は、前記データ線の一方側から前記画像信号が供給されると共に、他方側から前記プリチャージ信号が供給されることを特徴とする請求項１から９のいずれか一項に記載の液晶装置。

【請求項１１】　当該液晶装置に対し所定の検査を行うための第４スイッチング素子を含む検査回路が前記第１基板に更に設けられており、

前記遮光層は、前記第４スイッチング素子に対向する位置において前記第１基板と前記第４スイッチング素子との間に更に設けられたことを特徴とする請求項１から１０のいずれか一項に記載の液晶装置。

【請求項１２】　請求項１に記載の液晶装置において、

前記少なくとも一方の回路に代えて、当該液晶装置を動作させるための電圧保持用の第５スイッチング素子を含む周辺回路が前記第１基板に設けられており、

前記遮光層は、前記第５スイッチング素子に対向する位置において前記第１基板と前記第５スイッチング素子との間に設けられたことを特徴とする液晶装置。

【請求項１３】　請求項１から１２に記載の液晶装置を備えたことを特徴とする電子機器。

【請求項１４】　光源と、該光源から出射される光が入射されて画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を投射する投射手段とを有する投射型表示装置において、

前記液晶ライトバルブは、光の入射側に配置された第１基板及び出射側に配置された第２基板との間に液晶が挟持された液晶装置と、前記第１基板の外側に配置された第１偏光手段と、前記第２基板の外側に配置された第２偏光手段とを有し、

前記第２基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１薄膜トランジスタと、前記複数の第１薄膜トランジスタに接続された複数の画素電極とを有し、

前記第２基板と前記第１薄膜トランジスタとの間には前記第１薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、

前記第２偏光手段と前記液晶装置との間には空間が形成されてなることを特徴とする投射型表示装置。

【請求項１５】　光源と、該光源から出射される光束を少なくとも２色の色光束に分離する色分離手段と、前記色分離手段によって分離された各色の光束に対して画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を合成する合成手段と、前記合成手段から出射された合成光束を投射する投射手段とを有する投射型表示装置において、
前記液晶ライトバルブは、光の入射側に配置された第１基板及び光の出射側に配置された第２基板との間に液晶が挟持されてなる液晶装置と、前記第１基板の外側に配置された第１偏光手段と、前記第２基板の外側に配置された第２偏光手段とを有し、
前記第２基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１薄膜トランジスタと、前記複数の第１薄膜トランジスタに接続された複数の画素電極とを有し、
前記第２基板と前記第１薄膜トランジスタとの間には前記第１薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、
前記第２偏光手段は、前記合成手段に貼りつけられていることを特徴とする投射型表示装置。
【請求項１６】　前記合成手段がプリズムユニットからなることを特徴とする請求項１５に記載の投射型表示装置。
【請求項１７】　前記液晶装置と、前記第２偏光手段との間に風を送るための送風手段を更に備えたことを特徴とする請求項１４乃至請求項１６のいずれか一項に記載の投射型表示装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、薄膜トランジスタ（以下適宜、ＴＦＴと称す）駆動によるアクティブマトリクス駆動方式の液晶装置及びこれを用いた電子機器の技術分野に属し、特に、液晶プロジェクタ等に用いられる、ＴＦＴの下側に遮光層を設けた形式の液晶装置及びこれを用いた電子機器の技術分野に属する。
【０００２】
【従来の技術】従来、この種の液晶装置が液晶プロジェクタ等にライトバルブとして用いられる場合には一般に、液晶層を挟んでＴＦＴアレイ基板に対向配置される対向基板の側から投射光が入射される。ここで、投射光がＴＦＴのアモルファスシリコン膜やポリシリコン膜から構成されたチャネル形成用の領域に入射すると、この領域において光電変換効果により光電流が発生してしまいＴＦＴのトランジスタ特性が劣化する。このため、対向基板には、各ＴＦＴに夫々対向する位置に、Ｃｒ（クロム）などの金属材料や樹脂ブラックなどから遮光層が形成されるのが一般的である。
【０００３】更に、この種の液晶装置においては、特に

トップゲート構造（即ち、ＴＦＴアレイ基板上においてゲート電極がチャネルの上側に設けられた構造）を採る正スタガ型又はコプラナー型のアモルファスシリコン又はポリシリコンＴＦＴを用いる場合には、投射光の一部が液晶プロジェクタ内の投射光学系により戻り光として、ＴＦＴアレイ基板の側からＴＦＴのチャネルに入射するのを防ぐ必要がある。同様に、投射光が通過する際のＴＦＴアレイ基板の表面からの反射光や、更にカラー用に複数の液晶装置を組み合わせて使用する場合の他の液晶装置から出射した後に投射光学系を突き抜けてくる投射光の一部が、戻り光としてＴＦＴアレイ基板の側からＴＦＴのチャネル領域に入射するのを防ぐ必要もある。このために、特開平９－１２７４９７号公報、特公平３－５２６１１号公報、特開平３－１２５１２３号公報、特開平８－１７１１０１号公報等では、石英基板等からなるＴＦＴアレイ基板上においてＴＦＴに対向する位置（即ち、ＴＦＴの下側）にも、例えば不透明な高融点金属から遮光層を形成した液晶装置を提案している。
【０００４】他方で、この種の液晶装置においては、走査線駆動回路、データ線駆動回路、プリチャージ回路、サンプリング回路、検査回路などのＴＦＴを構成要素とする各種の周辺回路が、このようなＴＦＴアレイ基板の上に設けられる場合がある。
【０００５】これらの周辺回路のうち、プリチャージ回路は、コントラスト比の向上、データ線の電位レベルの安定、表示画面上のラインむらの低減等を目的として、データ線に対し、データ線駆動回路から供給される画像信号に先行するタイミングで、プリチャージ信号（画像補助信号）を供給することにより、画像信号をデータ線に書き込む際の負荷を軽減する回路である。特に液晶を交流駆動するために通常行われるデータ線の電圧極性を所定周期で反転して駆動する所謂１Ｈ反転駆動方式においては、プリチャージ信号をデータ線に予め書き込んでおけば、画像信号をデータ線に書き込む際に必要な電気量を顕著に少なくできる。例えば、特開平７－２９５５２０号公報に、このようなプリチャージ回路の一例が開示されている。
【０００６】サンプリング回路は、高周波数の画像信号を各データ線に所定のタイミングで安定的に走査信号と同期して供給するために、画像信号をサンプリングする回路である。また、検査回路は、製造途中や出荷時の液晶装置の品質、欠陥等を検査するための回路である。その外にも、液晶表示における画質の向上、消費電力の低減、コストの低減等の観点から、ＴＦＴ等を用いた各種の周辺回路をＴＦＴアレイ基板上に設けることも可能である。
【０００７】ところで、この種の液晶装置内に封止された液晶に直流電圧を印加すると、液晶の劣化を招くことが知られている。このため一般には、液晶を直流駆動することは行われておらず、各画素に対する画像信号を例

えば１フィールド毎などの所定周期で電圧極性反転することにより、液晶を交流駆動するようにしている。しかるに前述の周辺回路を、液晶に面する基板部分に設けると、周辺回路における直流電圧成分が大なり小なり液晶に印加されてしまい、上記直流駆動した場合と同様に液晶の劣化を招いてしまう。従って、これらの周辺回路を液晶に面する基板部分に設けることは一般的ではない。また、周辺回路を液晶に面する基板部分に設けることは、有効表示面積を相対的に減じてしまう観点からも一般的ではない。このため、これらの周辺回路は、プラスチック等からなる遮光性のケースの内部に納められるＴＦＴアレイ基板の周辺部分に設けられている。従って、これらの周辺回路を構成するＴＦＴに対しては、前述の画素電極を駆動するＴＦＴのように、投射光に対する遮光層を対向基板側に設けたり、戻り光に対する遮光層をＴＦＴアレイ基板側に設けることはない。

【０００８】

【発明が解決しようとする課題】液晶装置においては、周辺回路を加えた液晶モジュールのサイズが同じであれば、マトリクス状に配置された複数の画素電極により規定される画面表示領域、即ち液晶装置上で実際に液晶の配向状態の変化により画像が表示される領域は、大きい程よいという一般的な要請がある。

【０００９】しかしながら、前述の周辺回路を遮光性のケースに納められた基板の周辺部分に設ける構成では、必然的にこのケース部分の幅が増してしまい、上記一般的な要請に答えることが出来ない。逆に、これらの周辺回路を無理に、狭く細長い周辺部分に設けると、特定の仕様に沿うようにこれら周辺回路を設計することが困難になるという問題点がある。

【００１０】また、画面表示領域にある液晶に面する基板部分に周辺回路を設けたのでは、周辺回路を構成するＴＦＴに対向基板側から投射光が入射したり、ＴＦＴアレイ基板側から戻り光が入射してしまう。このため、光電流が発生してＴＦＴのトランジスタ特性が劣化してしまうという問題点がある。これに加えて、画面表示領域にある液晶に面する基板部分に周辺回路を設けたのでは、有効表示面積の減少を招くと共に、直流電圧が周辺回路から液晶に印加されるのを防ぐための特殊構成が必要となるという問題点もある。

【００１１】本発明は上述した問題点に鑑みなされたものであり、プリチャージ回路、サンプリング回路、検査回路等の周辺回路が有するＴＦＴ等のスイッチング素子の下側からの戻り光等の光に対する遮光性能が高く、優れたスイッチング特性により高品質の画像表示が可能な液晶装置及び当該液晶装置を備えた電子機器を提供することを課題とする。

【００１２】

【課題を解決するための手段】請求項１に記載の液晶装置は上記課題を解決するために、一対の第１及び第２基

板との間に液晶が挟持されてなり、前記第１基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１スイッチング素子と、前記複数の第１スイッチング素子に接続された複数の画素電極とを有し、複数の第２スイッチング素子により画像信号をサンプリングして前記複数のデータ線に供給するサンプリング回路と、複数の第３スイッチング素子により前記複数のデータ線に所定電圧レベルのプリチャージ信号を前記画像信号に先行して夫々供給するプリチャージ回路とのうち少なくとも一方の回路が前記第１基板に配置されており、前記第１スイッチング素子並びに前記少なくとも一方の回路が有する前記第２及び第３スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置において、前記第１基板と前記第１スイッチング素子及び該一方の素子との間に夫々設けられた遮光層を更に備えたことを特徴とする。

【００１３】請求項１に記載の液晶装置によれば、サンプリング回路は、例えばＴＦＴ等からなる複数の第２スイッチング素子により画像信号をサンプリングして複数のデータ線に供給する。プリチャージ回路は、例えばＴＦＴ等からなる複数の第３スイッチング素子により複数のデータ線に所定電圧レベルのプリチャージ信号を画像信号に先行して夫々供給する。これらのサンプリング回路とプリチャージ回路とのうち少なくとも一方の回路は、第１基板に設けられている。ここで、第１スイッチング素子並びに該少なくとも一方の回路が有する第２及び第３スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置には、遮光層が、第１基板と第１スイッチング素子及び該一方の素子との間に夫々設けられている。従って、仮に第１基板の側から戻り光等が入射しても、例えばＴＦＴ等からなる第１、第２及び第３スイッチング素子に入射する以前に、これらに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばＴＦＴ等からなる第１、第２及び第３スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化する事態は未然に防止される。更にこのように、サンプリング回路やプリチャージ回路についての遮光が施されているため、これらの回路を従来のように遮光性のケースに入れられた第１基板の周辺部分に配置する必要性はなくなる。例えば、これらの回路を第２基板に形成された遮光性の周辺見切りに対向する第１基板部分に配置することもできる。

【００１４】請求項２に記載の液晶装置は上記課題を解決するために請求項１に記載の液晶装置において、前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、薄膜トランジスタからなり、前記遮光層上に絶縁膜を介して形成された該薄膜トランジスタを構成する半導体層を含むことを特徴とする。

【００１５】請求項２に記載の液晶装置によれば、第１、第２及び第３スイッチング素子のうち少なくとも一つは、遮光層上に絶縁膜を介して形成された薄膜トランジスタ（ＴＦＴ）を構成する半導体層を含むが、仮に第１基板の側から戻り光等が入射しても、該半導体層に入射する以前に、これに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該半導体層において光電変換効果により光電流が発生して、ＴＦＴのトランジスタ特性が劣化する事態は未然に防止される。

【００１６】請求項３に記載の液晶装置は上記課題を解決するために請求項１又は２に記載の液晶装置において、前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、ＬＤＤ構造の薄膜トランジスタからなり、前記遮光層は少なくとも該薄膜トランジスタのチャネル領域及びＬＤＤ領域に対向する位置に設けられていることを特徴とする。

【００１７】請求項３に記載の液晶装置によれば、第１、第２及び第３スイッチング素子のうち少なくとも一つは、ＬＤＤ構造のＴＦＴからなるが、遮光層は少なくとも該ＴＦＴのチャネル領域及びＬＤＤ領域に対向する位置に設けられているので、仮に第１基板の側から戻り光等が入射しても、該チャネル領域及びＬＤＤ領域に入射する以前に、これらに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該チャネル領域及びＬＤＤ領域において光電変換効果により光電流が発生して、ＴＦＴのトランジスタ特性が劣化する事態は未然に防止される。

【００１８】請求項４に記載の液晶装置は上記課題を解決するために請求項１から３のいずれか一項に記載の液晶装置において、前記遮光層は全域に渡って同一の薄膜形成工程により同一材料から形成されていることを特徴とする。

【００１９】請求項４に記載の液晶装置によれば、遮光層は各種のスイッチング素子に対して設けられているが、遮光層はその全域に渡って同一の薄膜形成工程により同一材料から形成されている。即ちこの場合、当該液晶装置の製造工程においては、各種のスイッチング素子に対する遮光層を同一の工程により形成することが可能となる。

【００２０】請求項５に記載の液晶装置は上記課題を解決するために請求項１から４のいずれか一項に記載の液晶装置において、前記遮光層は、定電位源に接続されていることを特徴とする。

【００２１】請求項５に記載の液晶装置によれば、遮光層は定電位源に接続されているので、遮光層は定電位とされる。従って、遮光層に対向配置されるＴＦＴ等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【００２２】請求項６に記載の液晶装置は上記課題を解決するために請求項５に記載の液晶装置において、前記定電位源の定電位は、接地電位に等しいことを特徴とする。

【００２３】請求項６に記載の液晶装置によれば、遮光層は接地電位とされるので、遮光層に対向配置されるＴＦＴ等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【００２４】請求項７に記載の液晶装置は上記課題を解決するために請求項５に記載の液晶装置において、前記第２基板の前記液晶に対面する側に設けられた対向電極を更に備えており、前記定電位源の定電位は、前記対向電極の電位に等しいことを特徴とする。

【００２５】請求項７に記載の液晶装置によれば、遮光層は対向電極の電位とされるので、遮光層に対向配置されるＴＦＴ等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【００２６】請求項８に記載の液晶装置は上記課題を解決するために請求項１から７のいずれか一項に記載の液晶装置において、前記第１、第２及び第３スイッチング素子のうち少なくとも一つは、Ｎチャネル型、Ｐチャネル型及び相補型のうちのいずれか一つの型の薄膜トランジスタからなることを特徴とする。

【００２７】請求項８に記載の液晶装置によれば、第１、第２及び第３スイッチング素子のうち少なくとも一つは、Ｎチャネル型、Ｐチャネル型及び相補型のうちのいずれか一つの型のＴＦＴからなるが、遮光層は少なくとも該ＴＦＴに対向する位置に設けられているので、仮に第１基板の側から戻り光等が入射しても、該ＴＦＴに入射する以前に、これに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該ＴＦＴにおいて光電変換効果により光電流が発生して、ＴＦＴのトランジスタ特性が劣化する事態は未然に防止される。

【００２８】請求項９に記載の液晶装置は上記課題を解決するために請求項１から８のいずれか一項に記載の液晶装置において、前記第１及び第２基板に平行な平面上で前記複数の画素電極により規定される画面表示領域の周囲において前記第１及び第２基板を貼り合わせて前記液晶を包囲するシール部材と、前記平面上で前記シール部材と前記画面表示領域との間において前記画面表示領域の輪郭に沿って前記第２基板に形成された遮光性の周辺見切りとを更に備えており、前記少なくとも一方の回路は、前記周辺見切りに対向する位置に設けられたことを特徴とする。

【００２９】請求項９に記載の液晶装置によれば、遮光性の周辺見切りは、液晶を包囲するシール部材と画面表示領域との間において画面表示領域の輪郭に沿って第２基板に形成されている。ここで、サンプリング回路及びプリチャージ回路のうち少なくとも一方の回路は、周辺見切りに対向する位置に設けられているので、周辺見切

りという言わばデッドスペースの有効利用を図ることができる。この場合特に、周辺見切りは遮光性であるので、投射光等が第２基板の側から入射しても、これらのサンプリング回路やプリチャージ回路が有するスイッチング素子に入射する以前に、周辺見切りにより、この投射光等は遮光される。従って、投射光等に起因して、スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化する不都合はない。このように周辺見切りに対向する位置にサンプリング回路やプリチャージ回路を配置すると、第２基板側からの光に対する遮光を施す必要がないので大変有利である。

【００３０】請求項１０に記載の液晶装置は上記課題を解決するために請求項１から９のいずれか一項に記載の液晶装置において、前記プリチャージ回路が設けられており、前記複数のデータ線は、前記データ線の一方側から前記画像信号が供給されると共に、他方側から前記プリチャージ信号が供給されることを特徴とする。

【００３１】請求項１０に記載の液晶装置によれば、複数のデータ線は、前記データ線の一方側から画像信号が供給され、前記データ線の他方側からプリチャージ信号が供給される。従って、プリチャージ回路を、画像信号を供給するためのデータ線駆動回路、サンプリング回路等と画面表示領域を挟んで反対の側に設けることができる。

【００３２】請求項１１に記載の液晶装置は上記課題を解決するために請求項１から１０のいずれか一項に記載の液晶装置において、当該液晶装置に対し所定の検査を行うための第４スイッチング素子を含む検査回路が前記第１基板に更に設けられており、前記遮光層は、前記第４スイッチング素子に対向する位置において前記第１基板と前記第４スイッチング素子との間に更に設けられたことを特徴とする。

【００３３】請求項１１に記載の液晶装置によれば、検査回路が有する第４スイッチング素子に対向する位置には、遮光層が、第１基板と該第４スイッチング素子との間に設けられている。従って、仮に第１基板の側から戻り光等が入射しても、例えばＴＦＴ等からなる第４スイッチング素子に入射する以前に、これに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばＴＦＴ等からなる第４スイッチング素子において光電変換効果により光電流が発生し、スイッチング特性が劣化する事態は未然に防止される。更にこのように、検査回路についての遮光が施されているため、例えば第２基板に形成された遮光性の周辺見切りに対向する第１基板部分に配置することもできる。

【００３４】請求項１２に記載の液晶装置は上記課題を解決するために請求項１に記載の液晶装置において、前記少なくとも一方の回路に代えて、当該液晶装置を動作させるための電圧保持用の第５スイッチング素子を含む周辺回路が前記第１基板に設けられており、前記遮光層は、前記第５スイッチング素子に対向する位置において前記第１基板と前記第５スイッチング素子との間に設けられたことを特徴とする。

【００３５】請求項１２に記載の液晶装置によれば、周辺回路が有する第５スイッチング素子に対向する位置には、遮光層が、第１基板と該第５スイッチング素子との間に設けられている。従って、仮に第１基板の側から戻り光等が入射しても、例えばＴＦＴ等からなる第５スイッチング素子に入射する以前に、これに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばＴＦＴ等からなる第５スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化して保持電圧が変化してしまう事態は未然に防止される。更にこのように、周辺回路についての遮光が施されているため、例えば第２基板に形成された遮光性の周辺見切りに対向する第１基板部分に配置することもできる。

【００３６】請求項１３に記載の電子機器は上記課題を解決するために請求項１から１２に記載の液晶装置を備えたことを特徴とする。

【００３７】請求項１３に記載の電子機器によれば、電子機器は、上述した本願発明の液晶装置を備えており、戻り光等に対する遮光性能が高く優れたスイッチング特性を持つスイッチング素子により各種の動作が行われるので、高品位の画像表示が可能となる。

【００３８】請求項１４に記載の投射型表示装置は、光源と、該光源から出射される光が入射されて画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を投射する投射手段とを有する投射型表示装置において、前記液晶ライトバルブは、光の入射側に配置された第１基板及び出射側に配置された第２基板との間に液晶が挟持された液晶装置と、前記第１基板の外側に配置された第１偏光手段と、前記第２基板の外側に配置された第２偏光手段とからなり、前記第２基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１薄膜トランジスタと、前記複数の第１薄膜トランジスタに接続された複数の画素電極とを有し、前記第２基板と前記第１薄膜トランジスタとの間には前記第１薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、前記第２偏光手段と前記液晶装置との間には空間が形成されてなることを特徴とする。

【００３９】請求項１４に記載の投射型表示装置によれば、第２基板と第１薄膜トランジスタとの間に遮光層を形成することにより、戻り光によるリーク電流を防ぐことができる。また戻り光による液晶ライトバルブへの影響を防ぐことができるため、従来のように反射防止膜付き偏光手段を液晶装置に貼り付けなくても良い。従って第２偏光手段を液晶装置に貼り付けることなく、離間形

成が可能であるため、液晶ライトバルブの温度上昇を防止することができる。

【００４０】請求項１５に記載の投射型表示装置は、光源と、該光源から出射される光束を少なくとも２色の色光束に分離する色分離手段と、前記色分離手段によって分離された各色の光束に対して画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を合成する合成手段と、前記合成手段から出射された合成光束を投射する投射手段とを有する投射型表示装置において、前記液晶ライトバルブは、光の入射側に配置された第１基板及び光の出射側に配置された第２基板との間に液晶が挟持されてなる液晶装置と、前記第１基板の外側に配置された第１偏光手段と、前記第２基板の外側に配置された第２偏光手段とを有し、前記第２基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第１薄膜トランジスタと、前記複数の第１薄膜トランジスタに接続された複数の画素電極とを有し、前記第２基板と前記第１薄膜トランジスタとの間には前記第１薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、前記第２偏光手段は、前記合成手段に貼りつけられていることを特徴とする。

【００４１】請求項１５に記載の投射型表示装置によれば、第２偏光手段が合成手段に貼り付けられているため、液晶装置と第２偏光手段との間には空間が形成される。従って、液晶装置の温度上昇を避けることができ、液晶ライトバルブの誤動作を防ぐことができる。

【００４２】請求項１６に記載の投射型表示装置は、請求項１５に記載の投射型表示装置において、前記合成手段がプリズムユニットからなることを特徴とする。

【００４３】請求項１６に記載の投射型表示装置によれば、前記合成手段がプリズムユニットからなり、第２偏光手段はプリズムユニットに貼り付けられている。プリズムユニットは熱容量が大きいため、第２偏光手段の熱容量をプリズムユニットで吸収することができ、液晶ライトバルブの温度上昇を防ぐために効果的である。

【００４４】請求項１７に記載の投射型表示装置は、請求項１５又は請求項１６に記載の投射型表示装置において、前記液晶装置と、前記第２偏光手段との間に冷風を送る冷却手段を更に備えたことを特徴とする。

【００４５】請求項１７に記載の投射型表示装置によれば、例えば合成手段の上側あるいは下側の一方に冷却手段を設け、冷却手段から液晶装置と偏光手段との間に冷風を送ることにより、液晶ライトバルブの温度上昇をさらに防ぐことができ、液晶ライトバルブの誤動作を防ぐことができる。

【００４６】本発明のこのような作用及び他の利得は次に説明する実施の形態から明らかにする。

【００４７】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づいて説明する。

【００４８】（液晶装置の構成）液晶装置の実施の形態の構成について図１から図５に基づいて説明する。

【００４９】先ず、液晶装置の全体構成について、図１から図３を参照して説明する。図１は、液晶装置の実施の形態におけるＴＦＴアレイ基板上に設けられた各種配線、周辺回路等の構成を示すブロック図であり、図２は、ＴＦＴアレイ基板をその上に形成された各構成要素と共に対向基板の側から見た平面図であり、図３は、対向基板を含めて示す図２のＨ－Ｈ’断面図である。

【００５０】図１において、液晶装置２００は、例えば石英基板、ハードガラス、シリコン基板等からなるＴＦＴアレイ基板１を備えている。ＴＦＴアレイ基板１上には、マトリクス状に設けられた複数の画素電極１１と、Ｘ方向に複数配列されており夫々がＹ方向に沿って伸びるデータ線３５と、Ｙ方向に複数配列されており夫々がＸ方向に沿って伸びる走査線３１と、各データ線３５と画素電極１１との間に夫々介在すると共に該間における導通状態及び非導通状態を、走査線３１を介して夫々供給される走査信号に応じて夫々制御するスイッチング素子の一例としての複数のＴＦＴ３０とが形成されている。またＴＦＴアレイ基板１上には、後述の蓄積容量（図６参照）のための配線である容量線３１’（第２蓄積容量電極）が、走査線３１と平行に形成されている。

【００５１】ＴＦＴアレイ基板１上には更に、複数のデータ線３５に所定電圧レベルのプリチャージ信号を画像信号に先行して夫々供給するプリチャージ回路２０１と、画像信号をサンプリングして複数のデータ線３５に夫々供給するサンプリング回路３０１と、データ線駆動回路１０１と、走査線駆動回路１０４とが形成されている。

【００５２】走査線駆動回路１０４は、外部制御回路から供給される電源、基準クロック等に基づいて、所定タイミングで走査線３１に走査信号をパルス的に線順次で印加する。

【００５３】データ線駆動回路１０１は、外部制御回路から供給される電源、基準クロック信号等に基づいて、走査線駆動回路１０４が走査信号を印加するタイミングに合わせて、たとえば６つの画像信号線３０４夫々について、データ線３５毎にサンプリング回路駆動信号をサンプリング回路３０１にサンプリング回路駆動信号線３０６を介して所定タイミングで順次供給する。

【００５４】プリチャージ回路２０１は、ＴＦＴ２０２を各データ線３５毎に備えており、プリチャージ信号線２０４がＴＦＴ２０２のソース電極に接続されており、プリチャージ回路駆動信号線２０６がＴＦＴ２０２のゲート電極に接続されている。そして、プリチャージ信号線２０４を介して、外部電源からプリチャージ信号（ＮＲＳ）を書き込むために必要な所定電圧の電源が供給さ

れ、プリチャージ回路駆動信号線２０６を介して、各データ線３５について画像信号（ＶＩＤ１～ＶＩＤ６）に先行するタイミングでプリチャージ信号を書き込むように、外部制御回路からプリチャージ回路駆動信号（ＮＲＧ）が供給される。プリチャージ回路２０１は、好ましくは中間階調レベルの画素データに相当するプリチャージ信号（画像補助信号）を供給する。

【００５５】サンプリング回路３０１は、ＴＦＴ３０２を各データ線３５毎に備えており、画像信号線３０４がＴＦＴ３０２のソース電極に接続されており、サンプリング回路駆動信号線３０６がＴＦＴ３０２のゲート電極に接続されている。そして、画像信号線３０４を介して、６つのパラレルな画像信号（ＶＩＤ１～ＶＩＤ６）が入力されると、これらの画像信号（ＶＩＤ１～ＶＩＤ６）をサンプリングする。また、サンプリング回路駆動信号線３０６を介して、データ線駆動回路１０１からサンプリング回路駆動信号が入力されると、６つの画像信号線３０４夫々についてサンプリングされた画像信号を、データ線３に順次印加する。即ち、データ線駆動回路１０１とサンプリング回路３０１とは、画像信号線３０４から入力された６相展開されたパラレルな画像信号（ＶＩＤ１～ＶＩＤ６）をデータ線３５に供給するように構成されている。本実施の形態ではデータ線３５を１本毎に順次選択していく方式を述べたが、例えば、隣接する６つのデータ線３５に接続されるサンプリング回路３０１を同時に選択し、６つのデータ線３５からなるグループ毎に順次転送していく方式でもよい。データ線３５の選択は、相隣接する２、３、…、５本或いは７本以上を同時に選択してもよい。また、データ線３５に供給される画像信号の相展開数は６相のみならず、サンプリング回路３０１を構成するＴＦＴ３０２の書き込み特性が良ければ、５相以下でもよいし、画像信号のドット周波数が高ければ、７相以上に増やしてもよい。この際、少なくとも画像信号の相展開数だけ画像画像入力信号線が必要なことは言うまでもない。

【００５６】本実施の形態では特に、各画素に設けられたＴＦＴ３０、プリチャージ回路２０１が有するＴＦＴ２０２及びサンプリング回路３０１が有するＴＦＴ３０２の下側には夫々遮光層３（後述する）が設けられている。従って、仮にＴＦＴアレイ基板１の側から戻り光等が入射しても、ＴＦＴ３０、２０２及び３０２に入射する以前に、これらに対向する位置に夫々形成された遮光層３により、この戻り光等は遮光される。このため、ＴＦＴ３０、２０２及び３０２において光電変換効果により光電流が発生してトランジスタ特性が劣化する事態は未然に防止され、フリッカーやクロストーク等の画質品位を著しく損なう不良は発生しない。尚、遮光層３の具体的な層構成については後述する。

【００５７】また、本実施の形態ではＴＦＴ３０、２０２及び３０２の少なくともチャネル領域下に形成された

遮光層３は、接地電位のような定電位線と電気的に接続するようにする。これは、ＴＦＴ３０、２０２及び３０２の各端子間に不安定な電位差が生じることにより起こるトランジスタ特性の変化を防ぐためである。定電位線としては、例えば、データ線駆動回路１０１や走査線駆動回路１０４等に供給される正電位或いは負電位の電源や、対向基板２に対向電極電位を供給する配線と電気的に接続してもよい。図１に示すように、走査線駆動回路１０４の負電位の電源等から延設された定電位線５０１は、画面表示領域の周辺で遮光層３に電気的に接続されている。また、画素の蓄積容量を形成するための容量線３１’へ供給する定電位線５０１と共用してもよい。このような構成を採れば、引き回し配線が１本で済むため、周辺回路を作り込むスペースが広がったり、液晶装置を小型化する際に有利である。また、専用の外部入力端子を必要としないので、スペースに余裕ができ、実装部材のコストダウンが図れる。但し、専用の外部入力端子と配線を設けて、定電位を供給してもよいことは言うまでもない。

【００５８】更にこのように、プリチャージ回路２０１やサンプリング回路３０１について、ＴＦＴアレイ基板１の側からの戻り光に対して遮光が施されているため、これらの回路を従来のように遮光性のケースに入れられたＴＦＴアレイ基板１の周辺部分に配置する必要性はなくなる。そこで、本実施の形態では図１中斜線領域で示すように且つ図２及び図３に示すように、プリチャージ回路２０１及びサンプリング回路３０１は、対向基板２に形成された遮光性の周辺見切り５３に対向する位置においてＴＦＴアレイ基板１上に設けられている。他方、データ線駆動回路１０１及び走査線駆動回路１０４は、液晶層５０に面しないＴＦＴアレイ基板１の狭く細長い周辺部分上に設けられている。

【００５９】図２及び図３において、ＴＦＴアレイ基板１の上には、複数の画素電極１１により規定される画面表示領域（即ち、実際に液晶層５０の配向状態変化により画像が表示される液晶装置の領域）の周囲において両基板を貼り合わせて液晶層５０を包囲するシール部材の一例としての光硬化性樹脂からなるシール材５２が、画面表示領域に沿って設けられている。そして、対向基板２上における画面表示領域とシール材５２との間には、遮光性の周辺見切り５３が設けられている。

【００６０】周辺見切り５３は、後に画面表示領域に対応して開口部が設けられた遮光性のケースにＴＦＴアレイ基板１が入れられた場合に、当該画面表示領域が製造誤差等により当該ケースの開口の縁に隠れてしまわないように、即ち、例えばＴＦＴアレイ基板１のケースに対する数百μｍ程度のずれを許容するように、画面表示領域の周囲に５００μｍ以上の幅を持つ帯状の遮光性材料から形成されたものである。このような遮光性の周辺見切り５３は、例えば、Ｃｒ（クロム）、Ｎｉ（ニッケ

ル）、Ａｌ（アルミニウム）などの金属材料を用いたスパッタリング、フォトリソグラフィ及びエッチングにより対向基板２に形成される。或いは、カーボンやＴｉ（チタン）をフォトレジストに分散した樹脂ブラックなどの材料から形成される。

【００６１】シール材５２の外側の領域には、画面表示領域の下辺に沿ってデータ線駆動回路１０１及び実装端子１０２が設けられており、画面表示領域の左右の２辺に沿って走査線駆動回路１０４が設けられている。更に画面表示領域の上辺には、画面表示領域の両側に設けられた走査線駆動回路１０４間をつなぐための複数の配線１０５が設けられている。また、対向基板２のコーナー部の少なくとも一箇所において、ＴＦＴアレイ基板１と対向基板２との間で電気的導通をとるための導通材からなる銀点１０６が設けられている。そして、シール材５２とほぼ同じ輪郭を持つ対向基板２が当該シール材５２によりＴＦＴアレイ基板１に固着されている。

【００６２】プリチャージ回路２０１及びサンプリング回路３０１は、基本的に交流駆動の回路である。このため、シール材５２により包囲され両基板間に挟持された液晶層５０に面するＴＦＴアレイ基板１部分にこれらのプリチャージ回路２０１及びサンプリング回路３０１を設けても、直流電圧印加による液晶層５０の劣化という問題は生じない。これに対して、データ線駆動回路１０１及び走査線駆動回路１０４は、液晶層５０に面することのないＴＦＴアレイ基板１の周辺部分に設けられている。従って、液晶層５０に、特に直流駆動されるデータ線駆動回路１０１や走査線駆動回路１０４からの直流電圧成分が、漏れ込んで印加されることを未然に防止できる。

【００６３】このように周辺見切り５３下に、プリチャージ回路２０１及びサンプリング回路３０１を設けることで、走査線駆動回路１０４やデータ線駆動回路１０１をＴＦＴアレイ基板１の周辺部分に余裕を持って形成することができ、特定の仕様に沿うようにこれらの周辺回路を設計することが容易になる。また、言わばデッドスペースである周辺見切り５３下に、プリチャージ回路２０１やサンプリング回路３０１を設けることで、液晶装置２００における有効表示面積の減少を招くこともない。

【００６４】そして一方で、周辺見切り５３は遮光性であるので、対向基板２の側から入射する投射光等に対する遮光手段をプリチャージ回路２０１やサンプリング回路３０１（即ち、ＴＦＴ２０２及び３０２）の上に別途設ける必要は無い。他方で、遮光層がプリチャージ回路２０１やサンプリング回路３０１（即ち、ＴＦＴ２０２及び３０２）の少なくともチャネル領域下に設けられているので、ＴＦＴアレイ基板１の側から入射する戻り光等をプリチャージ回路２０１やサンプリング回路３０１（即ち、ＴＦＴ２０２及び３０２）に届く前に遮光できる。これにより、プリチャージ回路２０１のＴＦＴ２０２、或いはサンプリング回路３０１のＴＦＴ３０２の少なくともチャネル領域に光が照射されることがないので、この領域において光電変換効果により光電流が発生し、ＴＦＴ２０２、３０２のトランジスタ特性は劣化することがない。従って、本実施の形態は、液晶装置のどちらの側から光が入射しようとも、確実に遮光できるという長所があり、フリッカーやクロストーク等の画質品位を著しく低下させる不良をなくすことができる。

【００６５】加えて、シール材５２に面するＴＦＴアレイ基板１部分にプリチャージ回路２０１やサンプリング回路３０１を形成する訳ではないので、これらの回路を構成するＴＦＴ２０２及び３０２をシール材５２に混入されたスペーサにより破壊する恐れはなく、更に、シール材５２を光硬化させる工程で両基板側から光を十分に照射できる。

【００６６】図１に示したように本実施の形態では、複数のデータ線３５は、画面表示領域の下辺にある一端から画像信号が供給され、他方の側にある他端からプリチャージ信号が供給される。従って、プリチャージ回路２０１を、画像信号を供給するためのデータ線駆動回路１０１及びサンプリング回路３０１と画面表示領域を挟んで反対の側に設けることができ、周辺見切り５３下のスペースをバランス良く有効に利用できる。

【００６７】次に、プリチャージ回路２０１及びサンプリング回路３０１を構成するＴＦＴ２０２及び３０２の具体的な回路構成について図４及び図５を参照して夫々説明する。尚、図４は、プリチャージ回路２０１のＴＦＴ２０２を構成する各種のＴＦＴを示す回路図であり、図５は、サンプリング回路３０１のＴＦＴ３０２を構成する各種のＴＦＴを示す回路図である。

【００６８】図４（１）に示すようにプリチャージ回路２０１のＴＦＴ２０２（図１参照）は、Ｎチャネル型ＴＦＴ２０２ａから構成されてもよいし、図４（２）に示すようにＰチャネル型ＴＦＴ２０２ｂから構成されてもよいし、図４（３）に示すようにＮチャネル型ＴＦＴ及びＰチャネル型ＴＦＴから成る相補型ＴＦＴ２０２ｃから構成されてもよい。なお、図４（１）から図４（３）において、図１に示したプリチャージ回路駆動信号線２０６を介して入力されるプリチャージ回路駆動信号２０６ａ、２０６ｂは、ゲート電圧として各ＴＦＴ２０２ａ～２０２ｃに入力される。同じく図１に示したプリチャージ信号線２０４を介して入力されるプリチャージ信号ＮＲＳは、ソース電圧として各ＴＦＴ２０２ａ～２０２ｃに入力される。Ｎチャネル型ＴＦＴ２０２ａにゲート電圧として印加されるプリチャージ回路駆動信号２０６ａと、Ｐチャネル型ＴＦＴ２０２ｂにゲート電圧として印加されるプリチャージ回路駆動信号２０６ｂとは、相互に反転信号である。従って、プリチャージ回路２０１を相補型ＴＦＴ２０２ｃで構成する場合には、プリチャ

ージ回路駆動信号線２０６が少なくとも２本以上必要となる。このようにプリチャージ回路駆動信号線２０６が２本以上になる場合、画面表示領域の一方の側に集中して配線してもよいし、プリチャージ信号線２０４と組み合わせて、画面表示領域の両側から配線してもよい。或いは、例えば、相補型ＴＦＴ２０２ｃの手前でプリチャージ回路駆動信号２０６ａをインバータにより反転させて、プリチャージ回路駆動信号２０６ｂを形成してもよい。

【００６９】図５（１）に示すようにサンプリング回路３０１のＴＦＴ３０２（図１参照）は、Ｎチャネル型ＴＦＴ３０２Ａから構成されてもよいし、図５（２）に示すようにＰチャネル型ＴＦＴ３０２Ｂから構成されてもよいし、図５（３）に示すように相補型ＴＦＴ３０２Ｃから構成されてもよい。なお、図５（１）から図５（３）において、図１に示した画像信号線３０４を介して入力される画像信号ＶＩＤは、ソース電圧として各ＴＦＴ３０２ａ～３０２ｃに入力される。同じく図１に示したデータ線駆動回路１０１からサンプリング回路駆動信号線３０６を介して入力されるサンプリング回路駆動信号３０６ａ、３０６ｂは、ゲート電圧として各ＴＦＴ３０２ａ～３０２ｃに入力される。また、サンプリング回路３０１においても、前述のプリチャージ回路２０１の場合と同様に、Ｎチャネル型ＴＦＴ３０２ａにゲート電圧として印加されるサンプリング回路駆動信号３０６ａと、Ｐチャネル型ＴＦＴ３０２Ｂにゲート電圧として印加されるサンプリング回路駆動信号３０６ｂとは、相互に反転信号である。従って、サンプリング回路３０１を相補型ＴＦＴ３０２Ｃで構成する場合には、サンプリング回路駆動信号３０６ａ、３０６ｂ用のサンプリング回路駆動信号線３０６が少なくとも２本以上必要となる。

【００７０】（液晶装置の構成）次に、液晶装置２００が含む液晶装置部分の具体的構成について図６から図８を参照して説明する。ここに、図７は図１において円で囲まれたＤの領域を拡大した平面図であり、図６は図７におけるＴＦＴ３０のＡ－Ａ’に沿った断面図と、プリチャージ回路２０１のＴＦＴ２０２のＢ－Ｂ’に沿った断面図を表している。尚、図６においては、各層や各部材を図面上で認識可能な程度の大きさとするため、各層や各部材毎に縮尺を異ならしめてある。

【００７１】図６の断面図において、液晶装置２００は、各画素に設けられるＴＦＴ３０部分において、ＴＦＴアレイ基板１並びにその上に積層された遮光層３、第１層間絶縁層４１、半導体層３２、ゲート絶縁層３３、走査線３１（ゲート電極）、第２層間絶縁層４２、データ線３５（ソース電極）、第３層間絶縁層４３、画素電極１１及び配向膜１２を備えている。液晶装置２００はまた、例えばガラス基板から成る対向基板２並びにその上に積層された共通電極２１、配向膜２２及び第２遮光層２３を備えている。液晶装置２００は更に、これらの両基板間に挟持された液晶層５０を備えている。

【００７２】ここでは先ず、これらの層のうち、ＴＦＴ３０を除く各層の構成について順に説明する。

【００７３】ＴＦＴ３０に夫々対向する位置においてＴＦＴアレイ基板１上には、遮光層３が夫々設けられている。　遮光層３は、Ｔｉ（チタン）、Ｃｒ（クロム）、Ｗ（タングステン）、Ｔａ（タンタル）、Ｍｏ（モリブデン）及びＰｄ（鉛）等の少なくとも一つを含む金属、或いは金属シリサイド（例えば、タングステンシリサイドＷＳｉ）等の金属合金からなる。遮光膜３を高融点金属シリサイドから構成すると、即ち、シリコンを遮光層３の材料に含ませると、シリコンを含んでなるＴＦＴアレイ基板１や第１層間絶縁層４１との熱的相性が良くなる。

【００７４】また、遮光層３は、図７に示すようにコンタクトホール５０３を介して定電位線５０１を経て、接地されているか又は定電位源に接続されている。定電位線５０１としては、データ線駆動回路１０１や走査線駆動回路１０４等の周辺回路に供給される電源等の配線を延設するとよい。このため、遮光層３の電位が変化することにより、ＴＦＴ３０のスイッチング特性等に悪影響を及ぼすことがない。例えば、遮光層３は接地されてもよいし、或いは共通電極２１に接続されて共通電極２１の電位にされてもよい。但し、遮光層３は電気的に浮遊していてもよい。また遮光層３を後述の蓄積容量（図６参照）用の配線として使用することも可能である。

【００７５】更に、遮光層３と複数のＴＦＴ３０との間には、第１層間絶縁層４１が設けられている。第１層間絶縁層４１は、例えば、ＮＳＧ（ノンドープシリケートガラス）、ＰＳＧ（リンシリケートガラス）、ＢＳＧ（ボロンシリケートガラス）、ＢＰＳＧ（ボロンリンシリケートガラス）などのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなり、ＴＦＴ３０を構成する半導体層３２を遮光層３から電気的絶縁するために設けられるものである。更に、第１層間絶縁層４１は、ＴＦＴアレイ基板１の全面に形成されることにより、ＴＦＴ３０のための下地膜としての機能をも有する。即ち、ＴＦＴアレイ基板１の表面の研磨時における荒れや、洗浄後に残る汚れ等でＴＦＴ３０の特性の劣化を防止する機能を有する。

【００７６】第２層間絶縁層４２及び第３層間絶縁層４３は夫々、ＮＳＧ、ＰＳＧ、ＢＳＧ、ＢＰＳＧなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる。

【００７７】画素電極１１は例えば、ＩＴＯ膜（インジウム・ティン・オキサイド膜）などの透明導電性薄膜からなる。尚、当該液晶装置２００を反射型の液晶装置に用いる場合には、Ａｌ等の反射率の高い不透明な材料から画素電極１１を形成してもよい。

【００７８】配向膜１２は例えば、ポリイミド薄膜などの有機薄膜からなり、所定のプレティルト角を持つように且つ所定方向でラビング処理が施されている。

【００７９】共通電極２１は、対向基板２の全面に渡ってＩＴＯ膜等から形成されている。

【００８０】配向膜２２は、例えば、ポリイミド薄膜などの有機薄膜からなり、所定のプレティルト角を持つように且つ所定方向でラビング処理が施されている。

【００８１】第２遮光層２３は、ＴＦＴ３０に対向する所定領域にＣｒやＮｉなどの金属材料やカーボンやＴｉをフォトレジストに分散した樹脂ブラックなどの材料から形成されている。第２遮光層２３は、ＴＦＴ３０の半導体層３２に対する遮光の他に、コントラストの向上、色材の混色防止などの機能を有する。

【００８２】液晶層５０は、画素電極１１と共通電極２１とが対面するように配置されたＴＦＴアレイ基板１と対向基板２との間において、シール材５２（図２及び図３参照）により囲まれた空間に液晶が真空吸引等により封入されることにより形成される。液晶層５０は、画素電極１１からの電界が印加されていない状態で配向膜１２及び２２により所定の配向状態を採る。液晶層５０は、例えば一種又は数種類のネマティック液晶を混合した液晶からなる。シール材５２は、二つの基板１及び２をそれらの周辺で貼り合わせるための、例えば光硬化性樹脂や熱硬化性樹脂からなる接着剤であり、両基板間の距離を所定値とするためのスペーサが混入されている。

【００８３】次に、ＴＦＴ３０に係る各層の構成について順に説明する。

【００８４】ＴＦＴ３０は、走査線３１（ゲート電極）、走査線３１からの電界によりチャネルが形成される半導体層３２、走査線３１と半導体層３２とを絶縁するゲート絶縁層３３、半導体層３２に形成されたソース領域３４、データ線３５（ソース電極）、及び半導体層３２に形成されたドレイン領域３６を備えている。ドレイン領域３６には、複数の画素電極１１のうちの対応する一つが接続されている。ソース領域３４及びドレイン領域３６は後述のように、半導体層３２に対し、Ｎ型又はＰ型のＴＦＴを形成するかに応じて所定濃度のＮ型用又はＰ型用のドーパントをドープすることにより形成されている。Ｎ型チャネルのタイプは、動作速度が速いという利点があり、画素のスイッチング素子であるＴＦＴ３０として用いられることが多い。

【００８５】ＴＦＴ３０は、好ましくはＬＤＤ構造を持つ。但し、ＴＦＴ３０は、ＬＤＤ構造における低濃度のソース・ドレイン領域にイオン注入を行わないオフセット構造を持ってもよいし、ゲート電極３１をマスクとして自己整合的にソース領域３４及びドレイン領域３６を形成してもよい。セルフアライン型のＴＦＴであってもよい。また、本実施の形態では、ＴＦＴ３０をシングルゲート構造で示したが、ソース領域３４とドレイン領域３６の間にゲート電極３１を２個直列に配設したデュアルゲート構造でもよいし、ゲート電極３１を３個以上配設してもよい。このような構造を採れば、ＴＦＴ３０のオフ時のリーク電流が低減されるため、画質品位の劣化を引き起こすことがない。

【００８６】走査線３１（ゲート電極）は、好ましくはポリシリコン膜から形成される。或いは、ＷやＭｏ等の高融点金属膜又は金属シリサイド膜から形成されてもよい。この場合、走査線３１（ゲート電極）を、第２遮光層２３が覆う領域の一部又は全部に対応する遮光膜として配置すれば、金属膜や金属シリサイド膜の持つ遮光性により、第２遮光層２３の一部又は全部を省略することも可能となる。この場合特に、対向基板２とＴＦＴアレイ基板１との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。

【００８７】ゲート絶縁層３３は、比較的薄い厚さの熱酸化膜からなる。尚、８インチ以上の大型基板を使用する場合、熱による基板のそりを防止するために、熱酸化時間を短くして、熱酸化膜を薄くし、この熱酸化膜上に高温酸化シリコン膜（ＨＴＯ膜）や窒化シリコン膜をＣＶＤ法等で堆積して、２層以上の多層ゲート絶縁膜構造を形成してもよい。

【００８８】一般にチャネルが形成される半導体層３２は、光が入射するとポリシリコン膜が有する光電変換効果により光電流が発生してしまいＴＦＴ３０のトランジスタ特性が劣化するが、本実施の形態では、対向基板２側からの投射光等の光に対しては、対向基板２に各ＴＦＴ３０に夫々対向する位置に複数の第２遮光層２３が形成されているので、投射された入射光が半導体層３２の少なくともチャネル領域に入射することが防止される。ところで、対向基板２上に形成される第２遮光層２３をＴＦＴアレイ基板１上に形成してもよい。この場合、データ線３５と画素電極１１との間にそれぞれ絶縁膜を介してＴｉ（チタン）等を形成すれば、対向基板２上の第２遮光層２３は省略できる。従って、対向基板２とＴＦＴアレイ基板１との組立時のアライメント精度を考慮する必要がないため、透過率のばらつきがない液晶装置を提供できる。

【００８９】データ線３５（ソース電極）は、画素電極１１と同様にＩＴＯ膜等の透明導電性薄膜から形成してもよい。或いは、Ａｌ等の低抵抗金属や金属シリサイド等から形成してもよい。

【００９０】更にこれに加えて又は代えて、走査線３１の一部からなるＴＦＴ３０のゲート電極を上側から覆うようにデータ線３５（ソース電極）をＡｌ等の不透明な金属薄膜から形成すれば、第２遮光層２３と共に又は単独で、半導体層３２の少なくともチャネル領域への入射光（即ち、図６で上側からの光）の照射を効果的に防ぐことが出来る。ここで、データ線３５は、ＴＦＴ３０において、少なくとも半導体層３２のチャネル領域とソー

ス・ドレイン領域３４及び３６との接合部と、これらの下方に配設される遮光層３を覆うように形成するとよい。これは、対向基板２側から入射した光が、遮光層３の表面で反射して、チャネル領域を照射するのを防ぐためである。他方、ＴＦＴアレイ基板１側からの戻り光等の光に対しては、ＴＦＴアレイ基板１に各ＴＦＴ３０に夫々対向する位置に複数の遮光層３が形成されているので、戻り光等が半導体層３２の少なくともチャネル領域に入射することが防止される。

【００９１】また、第２層間絶縁層４２には、ソース領域３４へ通じるコンタクトホール３７及びドレイン領域３６へ通じるコンタクトホール３８が夫々形成されている。このソース領域３４へのコンタクトホール３７を介して、データ線３５（ソース電極）はソース領域３４に電気的接続される。更に、第３層間絶縁層４３には、ドレイン領域３６へのコンタクトホール３８が形成されている。このドレイン領域３６へのコンタクトホール３８を介して、画素電極１１はドレイン領域３６に電気的接続される。前述の画素電極１１は、このように構成された第３層間絶縁層４３の上面に設けられている。

【００９２】ここで、図７の平面図に示すように、以上のように構成された画素電極１１は、ＴＦＴアレイ基板１上にマトリクス状に配列され、各画素電極１１に隣接してＴＦＴ３０が設けられており、また画素電極１１の縦横の境界に夫々沿ってデータ線３５（ソース電極）及び走査線３１（ゲート電極）が設けられている。また、遮光層３がＴＦＴ３０のチャネル部分等を下から覆っているのが分かる。図７において、Ｃ方向に位置する走査線駆動回路１０４の負電位の電源から延設された定電位線５０１は、画面表示領域の直近まで配設される。ここで、遮光層３とコンタクトホール５０３を介して電気的に接続される。遮光層３は、走査線３１に沿って平行にその下方に配設される。また、プリチャージ回路２０１のＴＦＴ２０２の少なくとも半導体層３２”のチャネル領域下を覆うように遮光層３”が形成され、画面表示領域の一方端から反対側の端まで、走査線３１と平行に配線される。更にトランジスタ特性が劣化しないように定電位線５０１にコンタクトホール５０３を介して電気的に接続する。また、定電位線５０１、プリチャージ回路２０１、プリチャージ回路駆動信号線２０６、プリチャージ信号線２０４等を従来デッドスペースであった周辺見切り５３下に形成することにより、周辺回路を作り込む領域を拡大できたり、液晶装置の小型化が実現できる。尚、図７は、説明の都合上、画素電極１１のマトリクス状配列等を簡略化して示すためのものであり、実際の各電極は層間絶縁層の間や上をコンタクトホール等を介して配線されており、図６から分かるように３次元的により複雑な構成を有している。

【００９３】再び図６において、画素電極１１には蓄積容量７０が夫々設けられている。この蓄積容量７０は、

より具体的には、半導体層３２のドレイン領域３６から延設形成された第１蓄積容量電極３２’、ゲート絶縁層３３と同一工程により形成される絶縁層３３’、走査線３１と同一工程により形成される容量線３１’（第２蓄積容量電極）、第２及び第３層間絶縁層４２及び４３、並びに第２及び第３層間絶縁層４２及び４３を介して容量線３１’に対向する画素電極１１の一部から構成されている。このように蓄積容量７０が設けられているため、デューティー比が小さくても高精細な表示が可能とされる。また、図７に示すように、走査線駆動回路１０４から延設された定電位線５０１と容量線３１’をコンタクトホール５０２において電気的に接続することにより、定電位供給源として利用できる。これにより、遮光層３と定電位線を共用できるため、配線が１本で済み、配線の引き回しにおいて有利である。更に、専用の外部入力端子を設ける必要がないので、入力端子数を減らすことができる。

【００９４】図６において、液晶装置２００には、プリチャージ回路２０１のＴＦＴ２０２（図１参照）がデータ線３５毎に設けられている。このＴＦＴ２０２は、より具体的には、半導体層３２と同一工程により形成される半導体層３２”、ゲート絶縁層３３と同一工程により形成されるゲート絶縁層３３”及び走査線３１（ゲート電極）と同一工程により形成されるプリチャージ回路駆動信号線２０６（ゲート電極）を備えている。半導体層３２”には、ＴＦＴ３０の場合と同様に、ソース領域３４”及びドレイン領域３６”が設けられ、第２層間絶縁層４２に開けられたコンタクトホール３８”を通じてドレイン領域３６”にはデータ線３５が接続されている。また、第２層間絶縁層４２に開けられたコンタクトホール３７”を通じてソース領域３４”にはプリチャージ信号線２０４が接続されている。そして、このような層構造を持つＴＦＴ２０２に対向する位置においてＴＦＴアレイ基板１上に、遮光層３と同一工程により形成される遮光層３”が少なくとも半導体層３２”のチャネル領域下を覆うように設けられている。しかも、ＴＦＴ２０２は、対向基板２に設けられた遮光性の周辺見切り５３に対向する位置において、ＴＦＴアレイ基板１上に設けられている。これにより、光が透過する開口領域の直近に周辺回路を形成することが可能となる。

【００９５】図７の平面図に示すように、プリチャージ回路２０１は、プリチャージ信号線２０４、プリチャージ回路駆動信号線２０６及びデータ線３５が平行に配置されている。尚、パターンレイアウトは必ずしも平行に配置する必要はない。プリチャージ信号線２０４は、各コンタクトホール３７”を介して各ＴＦＴ２０２のソース領域に電気的接続されており、データ線３５は各コンタクトホール３８”を介して各ＴＦＴ２０２のドレイン領域に電気的接続されている。また、プリチャージ回路駆動信号線２０６はＴＦＴ２０２のゲート電極として、

これらのソース領域とドレイン領域とを結ぶチャネル部分にゲート絶縁膜を介して対向配置されている。そして、チャネル部分をゲート電極と共に平面図で覆うように遮光層３”が設けられている。

【００９６】尚、図７には図示していないが、サンプリング回路３０１のＴＦＴ３０２（図１参照）は、プリチャージ回路２０１のＴＦＴ２０２と同様に構成されており、ＴＦＴ３０２に対向する位置においてＴＦＴアレイ基板１上に、遮光層３”が設けられている。しかも、ＴＦＴ３０２は、対向基板２に設けられた遮光性の周辺見切り５３に対向する位置において、ＴＦＴアレイ基板１上に設けられている。

【００９７】本実施の形態では特に、ＴＦＴ３０はポリシリコン膜を半導体層とするＴＦＴであるので、ＴＦＴ３０の形成時に同一薄膜形成工程で、サンプリング回路２０１、プリチャージ回路３０１、データ線駆動回路１０１、走査線駆動回路１０４等の周辺回路を形成できるので製造上有利である。例えば、データ線駆動回路１０１及び走査線駆動回路１０４は、図４（３）及び図５（３）に示したプリチャージ回路２０１やサンプリング回路３０１の場合と同様に、Ｎチャネル型ＴＦＴ及びＰチャネル型ＴＦＴから構成される相補構造の複数のＴＦＴからＴＦＴアレイ基板１上の周辺部分に形成される。

【００９８】このように本実施の形態では、ＴＦＴ３０、２０２及び３０２の少なくともチャネル領域下側に遮光層３が夫々設けられているので、前述のように戻り光等による悪影響が低減されるため、ＴＦＴ３０のトランジスタ特性が改善され、最終的には、液晶装置２００により、高コントラストで高画質の画像を表示することが可能となる。

【００９９】尚、図６には示されていないが、対向基板２の投射光が入射する側及びＴＦＴアレイ基板１の投射光が出射する側には夫々、例えば、ＴＮ（ツイステッドネマティック）モード、ＳＴＮ（スーパーＴＮ）モード、Ｄ－ＳＴＮ（ダブルーＳＴＮ）モード等の動作モードや、ノーマリーホワイトモード／ノーマリーブラックモードの別に応じて、偏光フィルム、位相差フィルム、偏光手段などが所定の方向で配置される。

【０１００】以上説明した液晶装置２００は、カラー液晶プロジェクタに適用されるため、３つの液晶装置２００がＲＧＢ用のライトバルブとして夫々用いられ、各液晶装置には夫々ＲＧＢ色分解用のダイクロイックミラーを介して分解された各色の光が入射光として夫々入射されることになる。従って、各実施の形態では、対向基板２に、カラーフィルタは設けられていない。しかしながら、液晶装置２００においてもブラックマトリックス２３の形成されていない画素電極１１に対向する所定領域にＲＧＢのカラーフィルタをその保護膜と共に、対向基板２上に形成してもよい。このようにすれば、液晶プロジェクタ以外の直視型や反射型のカラー液晶テレビなどのカラー液晶装置に本実施の形態の液晶装置を適用できる。更に、対向基板２上に１画素1個対応するようにマイクロレンズを形成してもよい。このようにすれば、入射光の集光効率を向上することで、明るい液晶装置が実現できる。更にまた、対向基板２上に、何層もの屈折率の相違する干渉層を堆積することで、光の干渉を利用して、ＲＧＢ色を作り出すダイクロイックフィルタを形成してもよい。このダイクロイックフィルタ付き対向基板によれば、より明るいカラー液晶装置が実現できる。

【０１０１】液晶装置２００では、従来と同様に入射光を対向基板２の側から入射することとしたが、遮光層３及び３”が存在するので、ＴＦＴアレイ基板１の側から入射光を入射し、対向基板２の側から出射するようにしても良い。即ち、このように液晶装置２００を液晶プロジェクタに取り付けても、チャネル形成用の半導体層３２及び３２”の少なくともチャネル領域に光が入射することを防ぐことが出来、高画質の画像を表示することが可能である。ここで従来は、ＴＦＴアレイ基板１の裏面側での反射を防止するために、反射防止用のＡＲ被膜された偏光手段を別途配置したり、ＡＲフィルムを貼り付ける必要があった。しかし、本実施の形態では、ＴＦＴアレイ基板１の表面と半導体層層３２及び３２”の少なくともチャネル領域との間に遮光層３が形成されているため、このようなＡＲ被膜された偏光手段やＡＲフィルムを用いたり、ＴＦＴアレイ基板１そのものをＡＲ処理した基板を使用する必要が無くなる。従って、本実施の形態によれば、材料コストを削減でき、また偏光手段貼り付け時に、ごみ、傷等により、歩留まりを落とすことがなく大変有利である。

【０１０２】また、液晶装置２００のスイッチング素子は、正スタガ型又はコプラナー型構造のＴＦＴであるとして説明したが、逆スタガ型構造のＴＦＴや他の形式のＴＦＴに対しても、本実施の形態は有効である。

【０１０３】更に、液晶装置２００においては、一例として液晶層５０をネマティック液晶から構成したが、液晶を高分子中に微小粒として分散させた高分子分散型液晶を用いれば、配向膜１２及び２２、並びに前述の偏光フィルム、偏光手段等が不要となり、光利用効率が高まることによる液晶装置の高輝度化や低消費電力化の利点が得られる。更に、画素電極１１をＡｌ等の反射率の高い金属膜から構成することにより、液晶装置２００を反射型液晶装置に適用する場合には、電圧無印加状態で液晶分子がほぼ垂直配向されたＳＨ（スーパーホメオトロピック）型液晶などを用いても良い。更にまた、液晶装置２００においては、液晶層５０に対し垂直な電界（縦電界）を印加するように対向基板２の側に共通電極２１を設けているが、液晶層５０に平行な電界（横電界）を印加するように一対の横電界発生用の電極から画素電極１１を夫々構成する（即ち、対向基板２の側には縦電界発生用の電極を設けることなく、ＴＦＴアレイ基板１の

側に横電界発生用の電極を設ける）ことも可能である。このように横電界を用いると、縦電界を用いた場合よりも視野角を広げる上で有利である。その他、各種の液晶材料（液晶相）、動作モード、液晶配列、駆動方法等に本実施の形態を適用することが可能である。

【０１０４】（検査回路の動作）以上説明した実施の形態では、プリチャージ回路２０１及びサンプリング回路３０１を設けるようにしたが、これらに代えて又は加えて周辺見切り５３下に、製造途中や出荷時の当該液晶装置の品質、欠陥等を検査するための所定の検査を行うためのＴＦＴを有する検査回路を設けてもよい。図９に、このような検査回路の一例を示す。

【０１０５】図９において、検査回路４０１は、複数のＴＦＴ４０２を備えている。ＴＦＴ４０２のゲートには、検査回路駆動信号ＴＸ１及びＴＸ２を夫々供給するための駆動信号線４０３ａ及び４０３ｂが接続されている。ＴＦＴ４０２のソースには、検査信号ＣＸ１～ＣＸ４を夫々供給するための検査信号線４０４ａ～４０４ｄが接続されている。そして、ＴＦＴ４０２のドレインには、データ線３５が接続されている。検査の際には、検査回路駆動信号ＴＸ１及びＴＸ２によりＴＦＴ４０２が、選択的にオンオフされ、所定電圧の検査信号ＣＸ１～ＣＸ４、所定電圧のプリチャージ信号及び所定電圧の画像信号が印加される。そして、検査信号線４０４ａ～４０４ｄに流れる電流値が測定され、予め経験的又は理論的に得られた無欠陥品における電流値と比較される。この結果、所定種類の組み合わせでこれらの印加電圧を印加して電流を測定することにより、例えば配線間における断線の検査、配線間におけるショート（短絡）の検査、プリチャージ回路２０１やサンプリング回路３０１における回路リークの検査等を比較的簡単に行うことができる。

【０１０６】このように、検査回路を設ける場合にも、検査回路が有するＴＦＴの少なくともチャネル領域下に遮光層３を設け、且つ検査回路を遮光層３と周辺見切り５３との間に設けるようにすれば、両基板側からの光に対する遮光がなされているため、光によりトランジスタ特性が劣化することはない。従って、通常に画面を表示する際には使用しない検査回路からのリーク電流により画質品位が著しく低下することはない。これに加えて、走査線駆動回路１０４やデータ線駆動回路１０１をＴＦＴアレイ基板１の周辺部分に余裕を持って形成することができ、液晶装置における有効表示面積の減少を招くこともない。尚、図９のような検査回路を設ける代わりに、図９のような検査回路の機能を兼ね備えた検査回路兼用のプリチャージ回路を設けるようにしてもよい。

【０１０７】更に、プリチャージ回路２０１及びサンプリング回路３０１に代えて又は加えて周辺見切り５３下に、図８に示すように当該液晶装置を動作させるための、データ線駆動回路１０１や走査線駆動回路１０４等

の電圧保持用のＴＦＴを有する周辺回路を設けてもよい。これらの周辺回路はその全て、或いは一部が周辺見切り５３に重なるように形成する。このような構成を採れば、シール領域は周辺回路の外側、すなわちＴＦＴアレイ基板１の最外周に設けるようにすれば、周辺回路領域を拡大することができる。この場合も、周辺回路が有するＴＦＴの少なくともチャネル領域下に遮光層３を設けるようにする。このように周辺回路を遮光層３と周辺見切り５３との間に設ければ、両基板側からの光に対する遮光がなされているため、光によりトランジスタ特性が劣化すること（例えば、保持電圧がリークしてしまうこと）はない。特に、このような周辺回路を交流駆動の回路とすれば、周辺見切り５３下に配置しても、前述の直流電圧印加による液晶層５０の劣化という問題は生じない。

【０１０８】また、データ線駆動回路１０１及び走査線駆動回路１０４をＴＦＴアレイ基板１の上に設ける代わりに、例えばＴＡＢ（テープオートメイテッドボンディング基板）上に実装された駆動用ＬＳＩに、ＴＦＴアレイ基板１の周辺部に設けられた異方性導電フィルムを介して電気的及び機械的に接続するようにしてもよい。

【０１０９】（製造プロセス）次に、プリチャージ回路２０１及びサンプリング回路３０１を含む液晶装置２０の製造プロセスについて図１０から図１２を参照して説明する。

【０１１０】先ず、遮光層３がＴＦＴアレイ基板１側に設けられたＴＦＴ３０部分の形成について図１０及び図１１を参照して説明する。

【０１１１】図１０の工程（１）に示すように、石英基板、ハードガラス、シリコン基板等のＴＦＴアレイ基板１を用意する。ここで、好ましくはN_2（窒素）等の不活性ガス雰囲気且つ約９００～１３００℃の高温でアニール処理し、後に実施される高温プロセスにおけるＴＦＴアレイ基板１に生じる歪みが少なくなるように前処理しておく。即ち、製造プロセスにおける最高温で高温処理される温度に合わせて、事前にＴＦＴアレイ基板１を同じ温度かそれ以上の温度で熱処理しておく。

【０１１２】このように処理されたＴＦＴアレイ基板１の全面に、スパッタリング等により、Ｔｉ、Ｃｒ、Ｗ、Ｔａ、Ｍｏ及びＰｄ等の少なくとも一つを含む金属、或いは金属シリサイド等の金属合金から成り、１０００～５０００Å程度の層厚の遮光膜を形成する。続いて、該形成された遮光膜上にフォトリソグラフィにより遮光層３のパターンに対応するマスクを形成し、該マスクを介して遮光膜に対しエッチングを行うことにより、遮光層３を形成する。

【０１１３】尚、遮光層３は、少なくともＴＦＴ３０の半導体層３２のうちチャンネル形成用の領域、ソース領域３４及びドレイン領域３６をＴＦＴアレイ基板１の裏面から見て覆うように形成される。

【０１１４】次に図１０の工程（２）に示すように、遮光層３の上に、例えば、常圧又は減圧ＣＶＤ法等によりＴＥＯＳ（テトラ・エチル・オルソ・シリケート）ガス、ＴＥＢ（テトラ・エチル・ボートレート）ガス、ＴＭＯＰ（テトラ・メチル・オキシ・フォスレート）ガス等を用いて、ＮＳＧ、ＰＳＧ、ＢＳＧ、ＢＰＳＧなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第１層間絶縁層４１を形成する。第１層間絶縁層４１の層厚は、約５００～１５０００Åが好ましい。或いは、熱酸化膜を形成した後、更に減圧ＣＶＤ法等により高温酸化シリコン膜（ＨＴＯ膜）や窒化シリコン膜を約５００Åの比較的薄い厚さに堆積し、厚さ約２０００Åの多層構造を持つ第１層間絶縁層４１を形成してもよい。更に、このようなシリケートガラス膜に重ねて又は代えて、ＳＯＧ（スピンオンガラス：紡糸状ガラス）をスピンコートして又はＣＭＰ（Ｃｈｅｍｉｃａｌ　Ｍｅｃｈａｎｉｃａｌ　Ｐｏｌｉｓｈｉｎｇ）処理を施すことにより、平坦な膜を形成してもよい。このように、第１層間絶縁層４１の上面をスピンコート処理又はＣＭＰ処理により平坦化しておけば、後に上側にＴＦＴ３０を形成し易いという利点が得られる。

【０１１５】尚、第１層間絶縁層４１に対し、約９００℃のアニール処理を施すことにより、汚染を防ぐと共に平坦化してもよい。

【０１１６】次に図１０の工程（３）に示すように、第１層間絶縁層４１の上に、約４５０～５５０℃、好ましくは約５００℃の比較的低温環境中で、流量約４００～６００ｃｃ／ｍｉｎのモノシランガス、ジシランガス等を用いた減圧ＣＶＤ（例えば、圧力約２０～４０ＰａのＣＶＤ）により、アモルファスシリコン膜を形成する。その後、窒素雰囲気中で、約６００～７００℃にて約１～１０時間、好ましくは、４～６時間のアニール処理を施すことにより、ポリシリコン膜を約５００～２０００Åの厚さ、好ましくは約１０００Åの厚さとなるまで固相成長させる。この際、Ｎチャネル型のＴＦＴを作成する場合には、Ｓｂ（アンチモン）、Ａｓ（砒素）、Ｐ（リン）などのＶ族元素のドーパントを僅かにイオン注入等によりドープしても良い。また、ＴＦＴをＰチャネル型とする場合には、Ａｌ（アルミニウム）、Ｂ（ボロン）、Ｇａ（ガリウム）、Ｉｎ（インジウム）などのIII族元素のドーパントを僅かにイオン注入等によりドープする。尚、アモルファスシリコン膜を経ないで、減圧ＣＶＤ法等によりポリシリコン膜を直接形成しても良い。或いは、減圧ＣＶＤ法等により堆積したポリシリコン膜にシリコンイオンを打ち込んで一旦非晶質化（アモルファス化）し、その後アニール処理等により再結晶化させてポリシリコン膜を形成しても良い。

【０１１７】次に図１０の工程（４）に示すように、半導体層３２を約９００～１３００℃の温度、好ましくは約１０００℃の温度により熱酸化することにより、約３００Åの比較的薄い厚さの熱酸化膜を形成し、更に減圧ＣＶＤ法等により高温酸化シリコン膜（ＨＴＯ膜）や窒化シリコン膜を約５００Åの比較的薄い厚さに堆積し、多層構造を持つゲート絶縁層３３を形成する。この結果、半導体層３２の厚さは、約３００～１５００Åの厚さ、好ましくは約３５０～４５０Åの厚さとなり、ゲート絶縁層３３の厚さは、約２００～１５００Åの厚さ、好ましくは約３００Åの厚さとなる。このように高温熱酸化時間を短くすることにより、特に８インチ程度の大型基板を使用する場合に熱によるそりを防止することができる。但し、半導体層３２を熱酸化することのみにより、単一層構造を持つゲート絶縁層３３を形成してもよい。

【０１１８】次に図１０の工程（５）に示すように、半導体層３２上にゲート絶縁層３３を介して、減圧ＣＶＤ法等によりポリシリコン膜を堆積した後、フォトリソグラフィ工程、エッチング工程等により、ゲート電極３１（走査線）を形成する。

【０１１９】但し、ゲート電極３１（走査線）を、ポリシリコン膜ではなく、高融点金属膜又は金属シリサイド膜とｐ－Ｓｉ膜を組み合わせて多層に形成してもよい。この場合、ゲート電極３１（走査線）を、第２遮光層２３が覆う領域の一部又は全部に対応する遮光膜として配置すれば、金属膜や金属シリサイド膜の持つ遮光性により、第２遮光層２３の一部又は全部を省略することも可能となる。この場合特に、対向基板２とＴＦＴアレイ基板１との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。

【０１２０】次に図１１の工程（６）に示すように、ＴＦＴ３０をＬＤＤ構造を持つＮチャネル型のＴＦＴとする場合、半導体層３２に、先ずソース領域３４及びドレイン領域３６のうちチャネル側に夫々隣接する一部を構成する低濃度ドープ領域を形成するために、ゲート電極３１を拡散マスクとして、ＰなどのＶ族元素のドーパントを低濃度で（例えば、Ｐイオンを１～３×10^{13}／cm^2のドーズ量にて）ドープし、続いて、ゲート電極３１よりも幅の広いマスクでレジスト層をゲート電極３１上に形成した後、同じくＰなどのＶ族元素のドーパントを高濃度で（例えば、Ｐイオンを１～３×10^{15}／cm^2のドーズ量にて）ドープする。また、ＴＦＴ３０をＰチャネル型とする場合、半導体層３２に、ソース領域３４及びドレイン領域３６を形成するために、ＢなどのIII族元素のドーパントを用いてドープする。このようにＬＤＤ構造とした場合、ショートチャネル効果を低減できる利点が得られる。尚、このように低濃度と高濃度の２段階に分けて、ドープを行わなくても良い。例えば、低濃度のドープを行わずに、オフセット構造のＴＦＴとしてもよく、ゲート電極３１をマスクとして、Ｐイオン、Ｂイオン等を用いたイオン注入技術によりセルフアライン型のＴＦＴとしてもよい。

【０１２１】これらの工程と並行して、Ｎチャネル型ＴＦＴ及びＰチャネル型ＴＦＴから構成される相補型構造を持つデータ線駆動回路１０１及び走査線駆動回路１０４をＴＦＴアレイ基板１上の周辺部に形成する。このように、ＴＦＴ３０はポリシリコンＴＦＴであるので、ＴＦＴ３０の形成時に同一工程で、データ線駆動回路１０１及び走査線駆動回路１０４を形成することができ、製造上有利である。

【０１２２】次に図１１の工程（７）に示すように、ゲート電極３１（走査線）を覆うように、例えば、常圧又は減圧ＣＶＤ法やＴＥＯＳガス等を用いて、ＮＳＧ、ＰＳＧ、ＢＳＧ、ＢＰＳＧなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第２層間絶縁層４２を形成する。第２層間絶縁層４２の層厚は、約５０００～１５０００Åが好ましい。そして、ソース領域３４及びドレイン領域３６を活性化するために約１０００℃のアニール処理を２０分程度行った後、ソース電極３５（データ線）に対するコンタクトホール３７を、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形成する。この際、反応性エッチング、反応性イオンビームエッチングのような異方性エッチングにより、コンタクトホール３７を開孔した方が、開孔形状をマスク形状とほぼ同じにできるという利点がある。但し、ドライエッチングとウエットエッチングとを組み合わせて開孔すれば、コンタクトホール３７をテーパ状にできるので、配線接続時の断線を防止できるという利点が得られる。また、ゲート電極３１（走査線）を図示しない配線と接続するためのコンタクトホールも、コンタクトホール３７と同一の工程により第２層間絶縁層４２に開ける。

【０１２３】次に図１１の工程（８）に示すように、第２層間絶縁層４２の上に、スパッタリング処理等により、Ａｌ等の低抵抗金属や金属シリサイド等を、約１０００～５０００Åの厚さに堆積し、更にフォトリソグラフィ工程、エッチング工程等により、ソース電極３５（データ線）を形成する。

【０１２４】この場合、ソース電極３５（データ線）を、第２遮光層２３が覆う領域の一部又は全部に対応する遮光膜として配置すれば、Ａｌ等の金属膜や金属シリサイド膜の持つ遮光性により、第２遮光層２３の一部又は全部を省略することも可能となる。この場合特に、対向基板２とＴＦＴアレイ基板１との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。また、少なくとも半導体層３２のチャネル領域を覆うようにソース電極３５を形成し、更に、半導体層３２のチャネル領域下方に配設された遮光層３の表面に入射光が直接照射されないようにソース電極３５で覆うようにする。これにより、入射光及び戻り光から半導体層３２のチャネル領域を保護できることから、ポリシリコン膜の光電変換効果によるＴＦＴのリーク電流を低減できる。

【０１２５】次に図１１の工程（９）に示すように、ソース電極３５（データ線）上を覆うように、例えば、常圧又は減圧ＣＶＤ法やＴＥＯＳガス等を用いて、ＮＳＧ、ＰＳＧ、ＢＳＧ、ＢＰＳＧなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第３層間絶縁層４３を形成する。第３層間絶縁層４３の層厚は、約５０００～１５０００Åが好ましい。或いは、このようなシリケートガラス膜に代えて又は重ねて、有機膜やＳＯＧ（スピンオンガラス）をスピンコートして、若しくは又はＣＭＰ処理を施して、平坦な膜を形成してもよい。

【０１２６】更に、画素電極１１とドレイン領域３６とを電気的接続するためのコンタクトホール３８を、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形成する。この際、反応性エッチング、反応性イオンビームエッチングのような異方性エッチングにより、コンタクトホール３８を開孔した方が、開孔形状をマスク形状とほぼ同じにできるという利点が得られる。但し、ドライエッチングとウエットエッチングとを組み合わせて開孔すれば、コンタクトホール３８をテーパ状にできるので、配線接続時の断線を防止できるという利点が得られる。

【０１２７】次に図１１の工程（１０）に示すように、第３層間絶縁層４３の上に、スパッタリング処理等により、ＩＴＯ膜等の透明導電性薄膜を、約５００～２０００Åの厚さに堆積し、更にフォトリソグラフィ工程、エッチング工程等により、画素電極１１を形成する。尚、当該液晶装置２００を反射型の液晶装置に用いる場合には、Ａｌ等の反射率の高い不透明な材料から画素電極１１を形成してもよい。

【０１２８】続いて、画素電極１１の上にポリイミド系の配向膜の塗布液を塗布した後、所定のプレティルト角を持つように且つ所定方向でラビング処理を施すこと等により、図１に示した配向膜１２が形成される。

【０１２９】次に、遮光層３”がＴＦＴアレイ基板１側に設けられたプリチャージ回路２０１のＴＦＴ２０２部分の形成について図８のＢ－Ｂ’断面図に基づいて図１２を参照して説明する。

【０１３０】プリチャージ回路２０１のＴＦＴ２０２部分の形成については、図１０及び図１１を参照して説明したＴＦＴ３０部分の形成と図１０の工程（１）から図１１の工程（６）までは、同一の薄膜形成工程で行われる。従って、その説明は省略する。

【０１３１】この場合、第２層間絶縁層４２にアニール処理を施すまでは図１１の工程（７）と同様であるが、その後、図１２の工程（７）に示すように、プリチャージ信号線２０４に対するコンタクトホール３７”と共にデータ線３５に対するコンタクトホール３８”を、図１１の工程（７）と並行して、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形

成する。

【０１３２】次に図１２の工程（８）に示すように、図１１の工程（８）と同一の薄膜形成工程により、第２層間絶縁層４２の上に、スパッタリング処理等により、Ａｌ等の低抵抗金属や金属シリサイド等を堆積する。更に図１１の工程（８）と並行して、フォトリソグラフィ工程、エッチング工程等により、所定パターンを夫々持つプリチャージ信号線２０４及びデータ線３５を形成する。

【０１３３】次に図１２の工程（９）に示すように、図１１の工程（９）と同一の薄膜形成工程により、データ線３５及びプリチャージ信号線２０４上を覆うようにシリケートガラス等からなる第３層間絶縁層４３を形成する。そして、図１１の工程（１０）の薄膜形成工程により、第３層間絶縁層４３の上に堆積されるＩＴＯ膜等の透明導電性薄膜については、エッチング処理等により全て除去する。

【０１３４】尚、遮光層３”がＴＦＴアレイ基板１側に設けられたサンプリング回路３０１のＴＦＴ３０２部分の形成については上述のプリチャージ回路２０１のＴＦＴ２０２部分の形成と同様であるので、その説明は省略する。

【０１３５】（電子機器）次に、以上詳細に説明した液晶装置２００を備えた電子機器の実施の形態について図１３から図１８を参照して説明する。

【０１３６】先ず図１３に、このように液晶装置２００を備えた電子機器の概略構成を示す。

【０１３７】図１３において、電子機器は、表示情報出力源１０００、表示情報処理回路１００２、前述の走査線駆動回路１０４及びデータ線駆動回路１０１を含む駆動回路１００４、前述のように構成されたプリチャージ回路及びサンプリング回路が設けられた液晶装置２００、クロック発生回路１００８並びに電源回路１０１０を備えて構成されている。表示情報出力源１０００は、ＲＯＭ（Read Only Memory）、ＲＡＭ（Random Access Memory）、光ディスク装置などのメモリ、同調回路等を含み、クロック発生回路１００８からのクロック信号に基づいて、所定フォーマットの画像信号などの表示情報を表示情報処理回路１００２に出力する。表示情報処理回路１００２は、増幅・極性反転回路、相展開回路、ローテーション回路、ガンマ補正回路、クランプ回路等の周知の各種処理回路を含んで構成されており、クロック信号に基づいて入力された表示情報からデジタル信号を順次生成し、クロック信号CLKと共に駆動回路１００４に出力する。駆動回路１００４は、走査線駆動回路１０４及びデータ線駆動回路１０１によって前述の駆動方法により液晶装置２００を駆動する。電源回路１０１０は、上述の各回路に所定電源を供給する。尚、液晶装置２００を構成するＴＦＴアレイ基板の上に、駆動回路１００４を搭載してもよく、これに加えて表示情報処理回路１００２を搭載してもよい。

【０１３８】次に図１４から図１８に、このように構成された電子機器の具体例を夫々示す。

【０１３９】図１４には、液晶プロジェクタ１１００は、上述した駆動回路１００４がＴＦＴアレイ基板上に搭載された液晶装置を含む液晶モジュールを３個用意し、夫々ＲＧＢ用の液晶装置９６２Ｒ、９６２Ｇ及び９６２Ｂとして用いた投射型プロジェクタの光学系の概略構成図を示し、図１５は、図１４のＥ－Ｅ’断面図である。本例の投射型表示装置の光学系には、前述した光源装置９２０と、均一照明光学系９２３が採用されている。そして、投射型表示装置は、この均一照明光学系９２３から出射される光束Ｗを赤（Ｒ）、緑（Ｇ）、青（Ｂ）に分離する色分離手段としての色分離光学系９２４と、各色光束Ｒ、Ｇ、Ｂを変調する変調手段としての３つのライトバルブ９２５Ｒ、９２５Ｇ、９２５Ｂと、変調された後の色光束を再合成する色合成手段としての色合成プリズム９１０と、合成された光束を投射面１００の表面に拡大投射する投射手段としての投射レンズユニット６を備えている。また、青色光束Ｂを対応するライトバルブ９２５Ｂに導く導光系９２７をも備えている。

【０１４０】均一照明光学系９２３は、２つのレンズ板９２１、９２２と反射ミラー９３１を備えており、反射ミラー９３１を挟んで２つのレンズ板９２１、９２２が直交する状態に配置されている。均一照明光学系９２３の２つのレンズ板９２１、９２２は、それぞれマトリクス状に配置された複数の矩形レンズを備えている。光源装置９２０から出射された光束は、第１のレンズ板９２１の矩形レンズによって複数の部分光束に分割される。そして、これらの部分光束は、第２のレンズ板９２２の矩形レンズによって３つのライトバルブ９２５Ｒ、９２５Ｇ、９２５Ｂ付近で重畳される。従って、均一照明光学系９２３を用いることにより、光源装置９２０が出射光束の断面内で不均一な照度分布を有している場合でも、３つのライトバルブ９２５Ｒ、９２５Ｇ、９２５Ｂを均一な照明光で照明することが可能となる。

【０１４１】各色分離光学系９２４は、青緑反射ダイクロイックミラー９４１と、緑反射ダイクロイックミラー９４２と、反射ミラー９４３から構成される。まず、青緑反射ダイクロイックミラー９４１において、光束Ｗに含まれている青色光束Ｂおよび緑色光束Ｇが直角に反射され、緑反射ダイクロイックミラー９４２の側に向かう。赤色光束Ｒはこのミラー９４１を通過して、後方の反射ミラー９４３で直角に反射されて、赤色光束Ｒの出射部９４４からプリズムユニット９１０の側に出射される。

【０１４２】次に、緑反射ダイクロイックミラー９４２において、青緑反射ダイクロイックミラー９４１において反射された青色、緑色光束Ｂ、Ｇのうち、緑色光束Ｇ

のみが直角に反射されて、緑色光束Ｇの出射部９４５から色合成光学系の側に出射される。緑反射ダイクロイックミラー９４２を通過した青色光束Ｂは、青色光束Ｂの出射部９４６から導光系９２７の側に出射される。本例では、均一照明光学素子の光束Ｗの出射部から、色分離光学系９２４における各色光束の出射部９４４、９４５、９４６までの距離がほぼ等しくなるように設定されている。

【０１４３】色分離光学系９２４の赤色、緑色光束Ｒ、Ｇの出射部９４４、９４５の出射側には、それぞれ集光レンズ９５１、９５２が配置されている。したがって、各出射部から出射した赤色、緑色光束Ｒ、Ｇは、これらの集光レンズ９５１、９５２に入射して平行化される。

【０１４４】このように平行化された赤色、緑色光束Ｒ、Ｇは、ライトバルブ９２５Ｒ、９２５Ｇに入射して変調され、各色光に対応した画像情報が付加される。すなわち、これらの液晶装置は、不図示の駆動手段によって画像情報に応じてスイッチング制御されて、これにより、ここを通過する各色光の変調が行われる。このような駆動手段は公知の手段をそのまま使用することができる。一方、青色光束Ｂは、導光系９２７を介して対応するライトバルブ９２５Ｂに導かれ、ここにおいて、同様に画像情報に応じて変調が施される。尚、本例のライトバルブ９２５Ｒ、９２５Ｇ、９２５Ｂは、それぞれさらに入射側偏光手段９６０Ｒ、９６０Ｇ、９６０Ｂと、出射側偏光手段９６１Ｒ、９６1Ｇ、９６１Ｂと、これらの間に配置された液晶装置９６２Ｒ、９６２Ｇ、９６２Ｂとからなる液晶ライトバルブである。

【０１４５】導光系９２７は、青色光束Ｂの出射部９４６の出射側に配置した集光レンズ９５４と、入射側反射ミラー９７１と、出射側反射ミラー９７２と、これらの反射ミラーの間に配置した中間レンズ９７３と、ライトバルブ９２５Ｂの手前側に配置した集光レンズ９５３とから構成されている。集光レンズ９４６から出射された青色光束Ｂは、導光系９２７を介して液晶装置９６２Ｂに導かれて変調される。各色光束の光路長、すなわち、光束Ｗの出射部から各液晶装置９６２Ｒ、９６２Ｇ、９６２Ｂまでの距離は青色光束Ｂが最も長くなり、したがって、青色光束の光量損失が最も多くなる。しかし、導光系９２７を介在させることにより、光量損失を抑制することができる。

【０１４６】各ライトバルブ９２５Ｒ、９２５Ｇ、９２５Ｂを通って変調された各色光束Ｒ、Ｇ、Ｂは、色合成プリズム９１０に入射され、ここで合成される。そして、この色合成プリズム９１０によって合成された光が投射レンズユニット９０６を介して所定の位置にある投射面１００の表面に拡大投射されるようになっている。

【０１４７】本実施の形態では、液晶装置９６２Ｒ、９６２Ｇ、９６２Ｂには、ＴＦＴの下側に遮光層が設けられているため、当該液晶装置９６２Ｒ、９６２Ｇ、９６２Ｂからの投射光に基づく液晶プロジェクタ内の投射光学系による反射光、投射光が通過する際のＴＦＴアレイ基板の表面からの反射光、他の液晶装置から出射した後に投射光学系を突き抜けてくる投射光の一部等が、戻り光としてＴＦＴアレイ基板の側から入射しても、画素電極のスイッチング用のＴＦＴ、あるいはサンプリング回路のＴＦＴ、プリチャージング回路のＴＦＴ、検査回路のＴＦＴ、或いはデータ線駆動回路や走査線駆動回路等の周辺回路等のチャネルに対する遮光を十分に行うことができる。

【０１４８】このため、小型化に適したプリズムユニットを投射光学系に用いても、各液晶装置９６２Ｒ、９６２Ｇ、９６２Ｂとプリズムユニットとの間において、戻り光防止用のフィルムを別途配置したり、偏光手段に戻り光防止処理を施したりすることが不要となるので、構成を小型且つ簡易化する上で大変有利である。

【０１４９】また、本実施の形態では、戻り光によるＴＦＴのチャネル領域への影響を抑えることができるため、液晶装置に直接戻り光防止処理を施した偏光手段を貼り付けなくてもよい。そこで、図１４及び図１５に示されるように、偏光手段を液晶装置から離して形成、より具体的には、一方の偏光手段９６１Ｒ、９６１Ｇ、９６１Ｂはプリズムユニット９１０に貼り付け、他方の偏光手段９６０Ｒ、９６０Ｇ、９６０Ｂは集光レンズ９５３、９４５、９４４に貼り付けることが可能である。このように、偏光手段をプリズムユニットに貼り付けることにより、偏光手段の熱は、プリズムユニットで吸収されるため、液晶装置の温度上昇を防止することができる。

【０１５０】また、図１５に示されるように、液晶装置と偏光手段と間を離して形成することにより、液晶装置と偏光手段との間には空気層ができるため、例えばプリズムユニットの上側あるいは下側の一方に冷却手段を設け、冷却手段から液晶装置と偏光手段との間に冷風等の送風を送風口９９０から送り込むことにより、液晶装置の温度上昇をさらに防ぐことができ、液晶装置の温度上昇による誤動作を防ぐことができる。

【０１５１】図１６において、電子機器の他の例たるラップトップ型のパーソナルコンピュータ１２００は、上述した液晶装置２００がトップカバーケース内に備えられており、更にＣＰＵ、メモリ、モデム等を収容すると共にキーボード１２０２が組み込まれた本体１２０４を備えている。

【０１５２】図１７において、電子機器の他の例たるページャ１３００は、金属フレーム１３０２内に前述の駆動回路１００４がＴＦＴアレイ基板上に搭載されて液晶モジュールをなす液晶装置２００が、バックライト１３０６ａを含むライトガイド１３０６、回路基板１３０８、第１及び第２のシールド板１３１０及び１３１２、二つの弾性導電体１３１４及び１３１６、並びにフィル

ムキャリアテープ１３１８と共に収容されている。この例の場合、前述の表示情報処理回路１００２（図１３参照）は、回路基板１３０８に搭載してもよく、液晶装置２００のＴＦＴアレイ基板上に搭載してもよい。更に、前述の駆動回路１００４を回路基板１３０８上に搭載することも可能である。

【０１５３】また図１８に示すように、駆動回路１００４や表示情報処理回路１００２を搭載しない液晶装置２００の場合には、駆動回路１００４や表示情報処理回路１００２を含むＩＣ１３２４がポリイミドテープ１３２２上に実装されたＴＣＰ（Tape Carrier Package）１３２０に、ＴＦＴアレイ基板１の周辺部に設けられた異方性導電フィルムを介して物理的且つ電気的に接続して、液晶装置として、生産、販売、使用等することも可能である。

【０１５４】以上図１４から図１８を参照して説明した電子機器の他にも、液晶テレビ、ビューファインダ型又はモニタ直視型のビデオテープレコーダ、カーナビゲーション装置、電子手帳、電卓、ワードプロセッサ、ワークステーション、携帯電話、テレビ電話、ＰＯＳ端末、タッチパネルを備えた装置等などが図１３に示した電子機器の例として挙げられる。

【０１５５】以上説明したように、本実施の形態によれば、戻り光等に対する遮光性能が高く、優れたトランジスタ特性を持つＴＦＴにより、高品位の画像表示が可能な液晶装置を備えた各種の電子機器を実現できる。

【０１５６】

【発明の効果】本発明によれば、例えばＴＦＴ等からなる第１、第２及び第３スイッチング素子において戻り光等に起因して光電流が発生してスイッチング特性が劣化する事態は未然に防止されるので、優れたスイッチング特性を持つスイッチング素子により、高品位の画像表示が可能となる。更にサンプリング回路やプリチャージ回路を従来のように遮光性のケースに入れられた第１基板の周辺部分に配置する必要性はないので、例えば、これらの回路を周辺見切り下に配置することにより、周辺見切りの下というデッドスペースを有効利用することも可能となる。

【０１５７】また、戻り光等に起因して半導体層に光電流が発生してＴＦＴのトランジスタ特性が劣化する事態は未然に防止されるので、優れたトランジスタ特性を持つＴＦＴにより、高品位の画像表示が可能となる。

【図面の簡単な説明】

【図１】　液晶装置の実施の形態におけるＴＦＴアレイ基板上に形成された各種配線、周辺回路等のブロック図である。

【図２】　図１の液晶装置の全体構成を示す平面図である。

【図３】　図１の液晶装置の全体構成を示す断面図である。

【図４】　液晶装置に設けられたプリチャージ回路を構成するＴＦＴの回路図である。

【図５】　液晶装置に設けられたサンプリング回路を構成するＴＦＴの回路図である。

【図６】　液晶装置を構成する画素スイッチング用ＴＦＴ及びプリチャージ回路用ＴＦＴを示す断面図である。

【図７】　図６の液晶装置のＴＦＴアレイ基板の画面表示領域のコーナー部を示す平面図である。

【図８】　図１の液晶装置の実施の形態におけるＴＦＴアレイ基板上に形成された各種配線、周辺回路等の応用例のブロック図である。

【図９】　検査回路の一例の回路図である。

【図１０】　図６の液晶装置の一部分における製造プロセスを順を追って示す工程図（その１）である。

【図１１】　図６の液晶装置の一部分における製造プロセスを順を追って示す工程図（その２）である。

【図１２】　図６の液晶装置の他部分における製造プロセスを順を追って示す工程図である。

【図１３】　本発明による電子機器の実施の形態の概略構成を示すブロック図である。

【図１４】　電子機器の一例としての液晶プロジェクタを示す断面図である。

【図１５】　図１４のＥ－Ｅ’断面図である。

【図１６】　電子機器の他の例としてのパーソナルコンピュータを示す正面図である。

【図１７】　電子機器の一例としてのページャを示す分解斜視図である。

【図１８】　電子機器の一例としてのＴＣＰを用いた液晶装置を示す斜視図である。

【符号の説明】

１…ＴＦＴアレイ基板
２…対向基板
３、３”…遮光層
１１…画素電極
１２…配向膜
２１…共通電極
２２…配向膜
２３…第２遮光層
３０、２０２、３０２…ＴＦＴ
３１…走査線（ゲート電極）
３２、３２”…半導体層
３３、３３”…ゲート絶縁層
３４、３４”…ソース領域
３５…データ線（ソース電極）
３６、３６”…ドレイン領域
３７、３７”、３８、３８”…コンタクトホール
４１…第１層間絶縁層
４２…第２層間絶縁層
４３…第３層間絶縁層
５０…液晶層

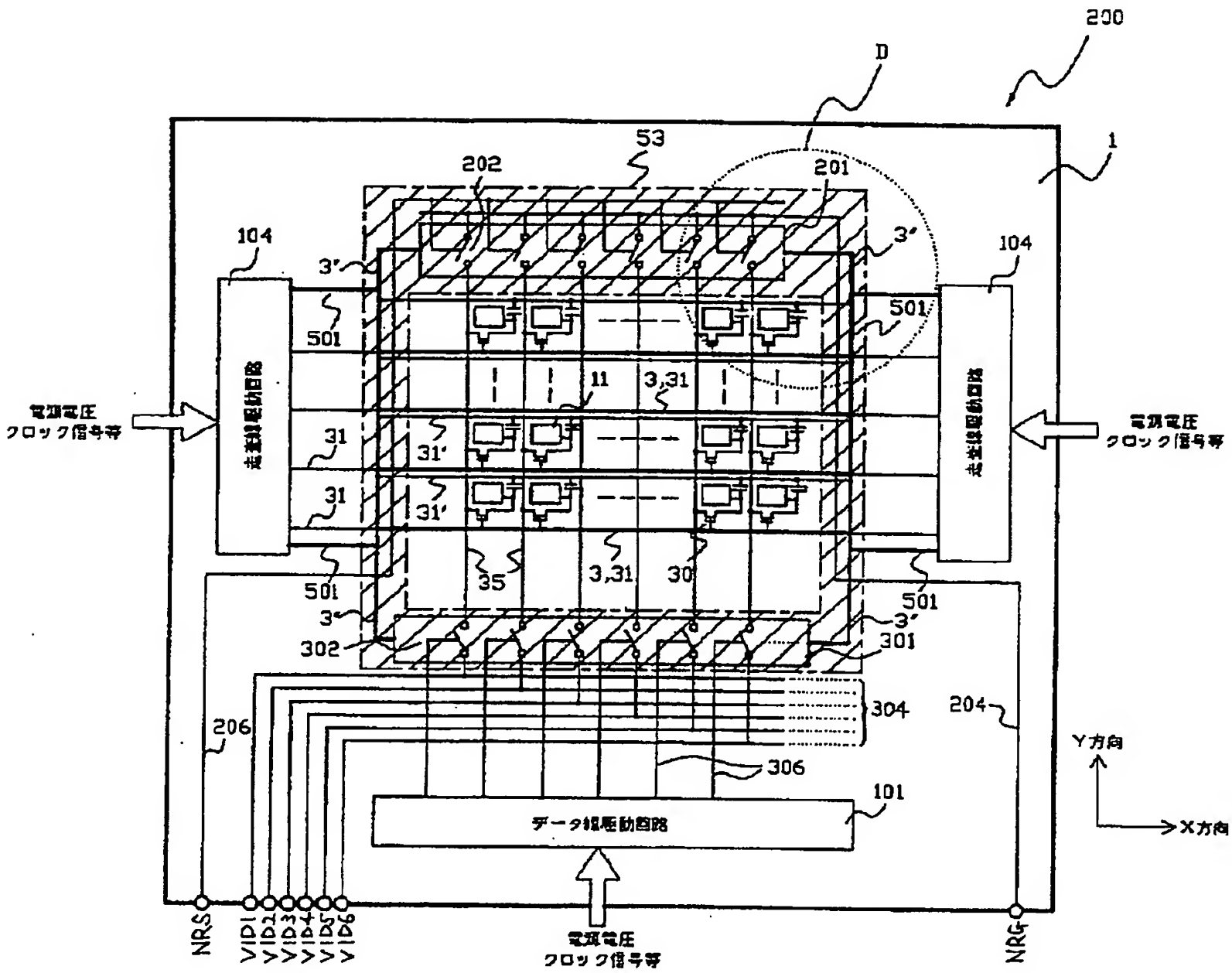
37

５２…シール材
５３…周辺見切り
７０…蓄積容量
１０１…データ線駆動回路
１０４…走査線駆動回路
２００…液晶装置
２０１…プリチャージ回路

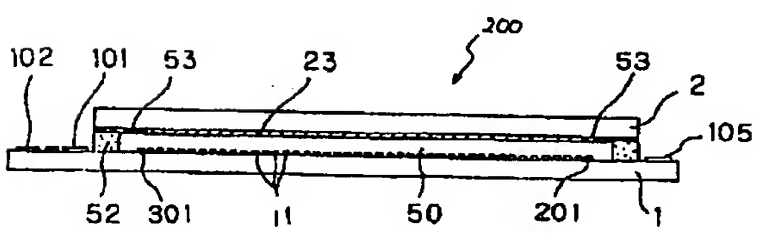
38

２０２…ＴＦＴ
２０４…プリチャージ信号線
２０６…プリチャージ回路駆動信号線
３０１…サンプリング回路
３０２…ＴＦＴ
４０１…検査回路
４０２…ＴＦＴ

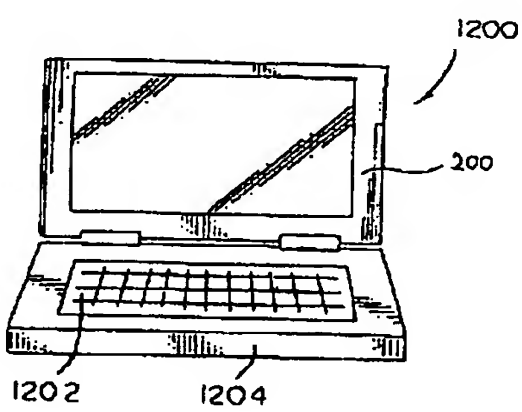
【図１】



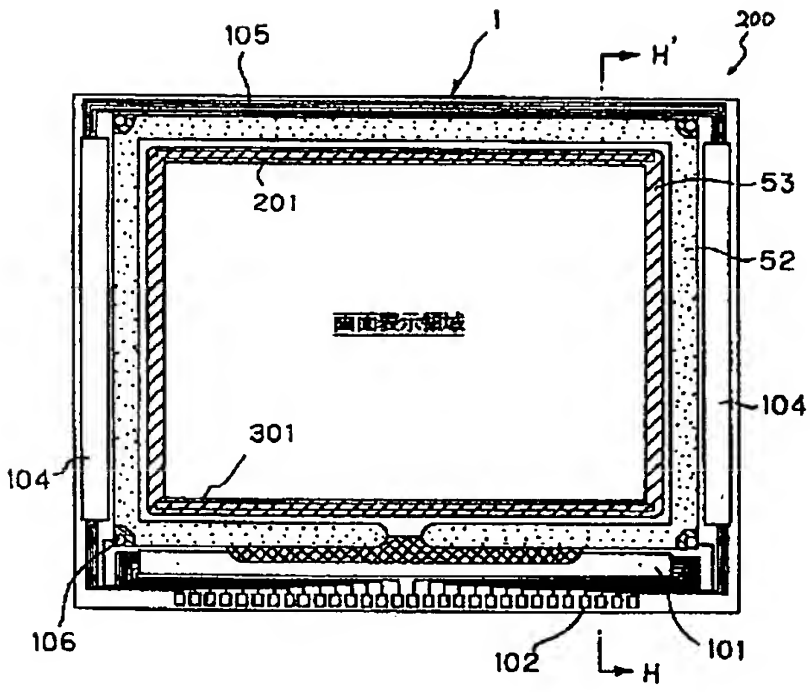
【図３】



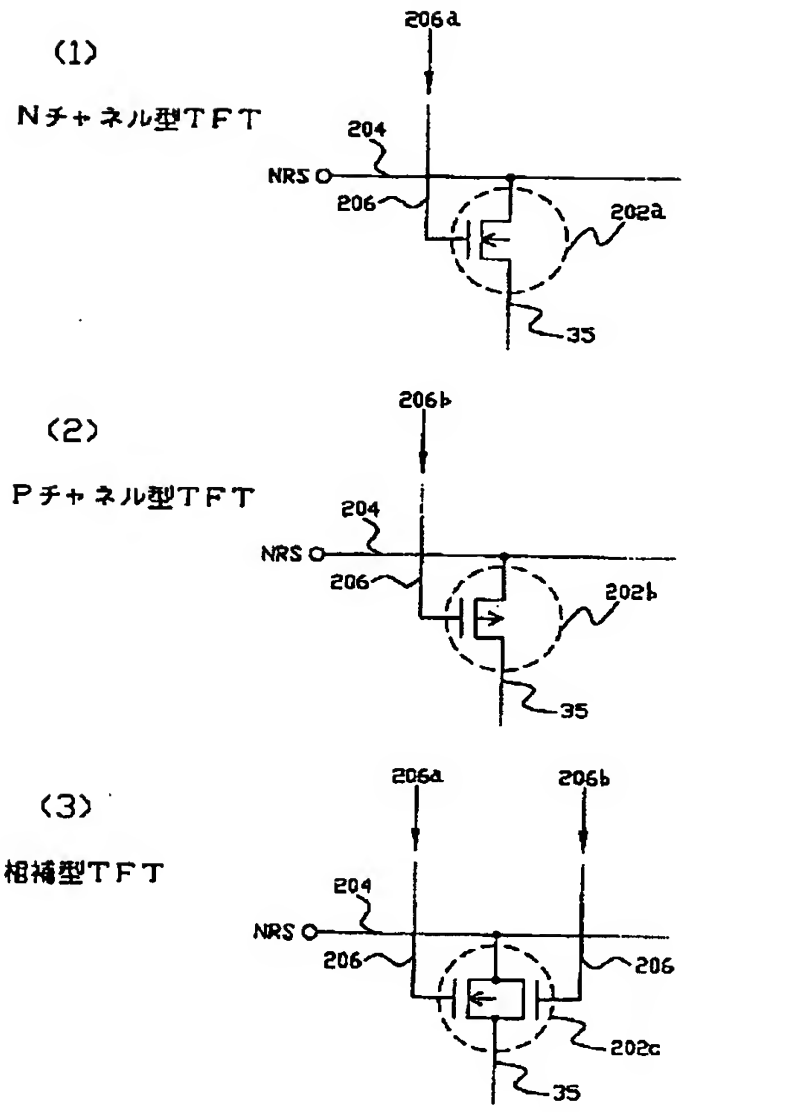
【図１６】



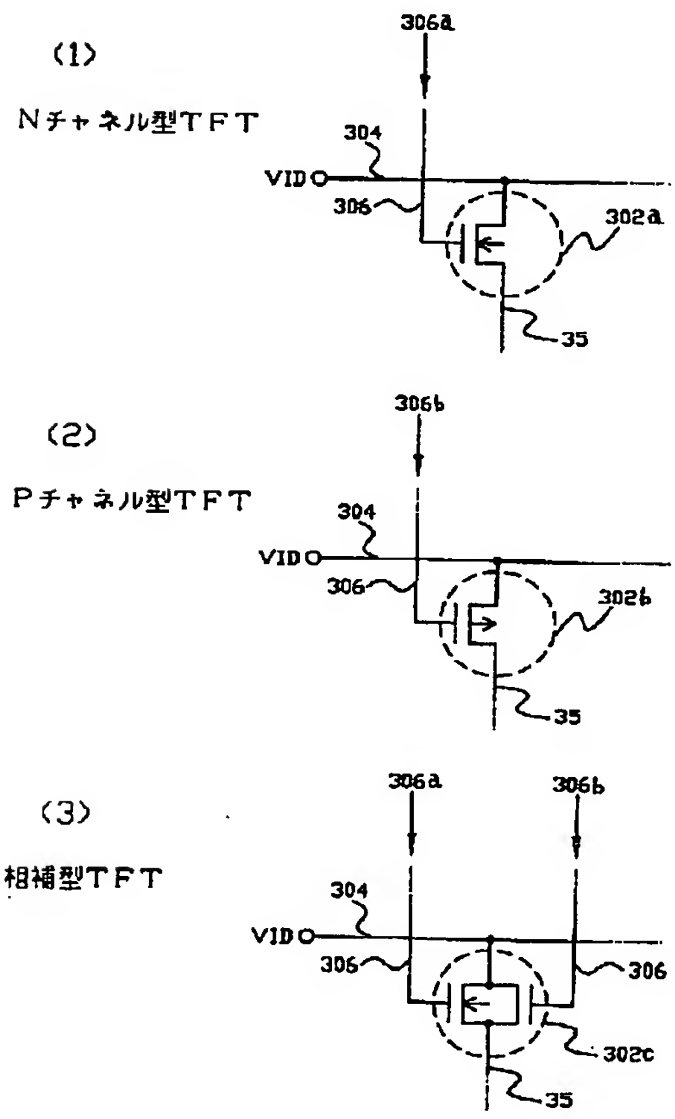
【図２】


105
1
200
H'
201
53
52
画面表示領域
104
301
104
106
102
101
H

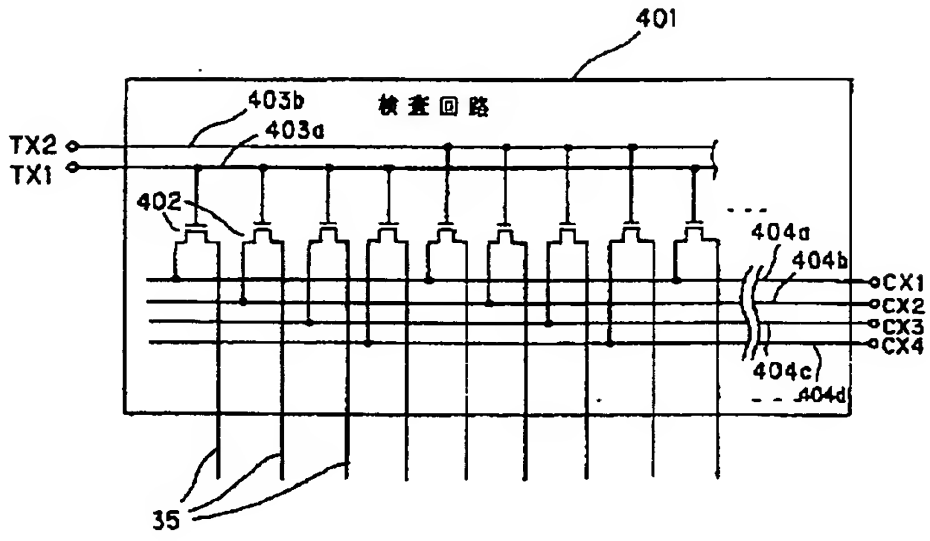
【図４】


(1)
Nチャネル型ＴＦＴ
206a
204
NRS
206
202a
35
(2)
Pチャネル型ＴＦＴ
206b
204
NRS
206
202b
35
(3)
相補型ＴＦＴ
206a
206b
204
NRS
206
206
202c
35

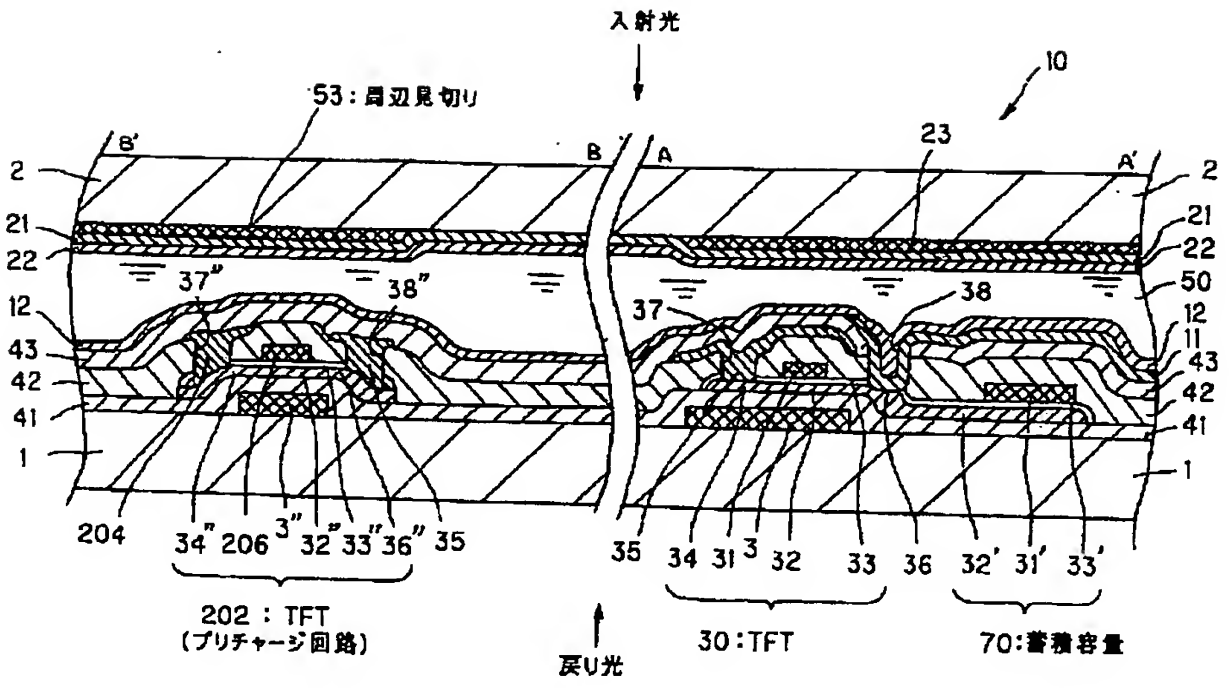
【図５】


(1)
Nチャネル型ＴＦＴ
306a
304
VID
306
302a
35
(2)
Pチャネル型ＴＦＴ
306b
304
VID
306
302b
35
(3)
相補型ＴＦＴ
306a
306b
304
VID
306
306
302c
35

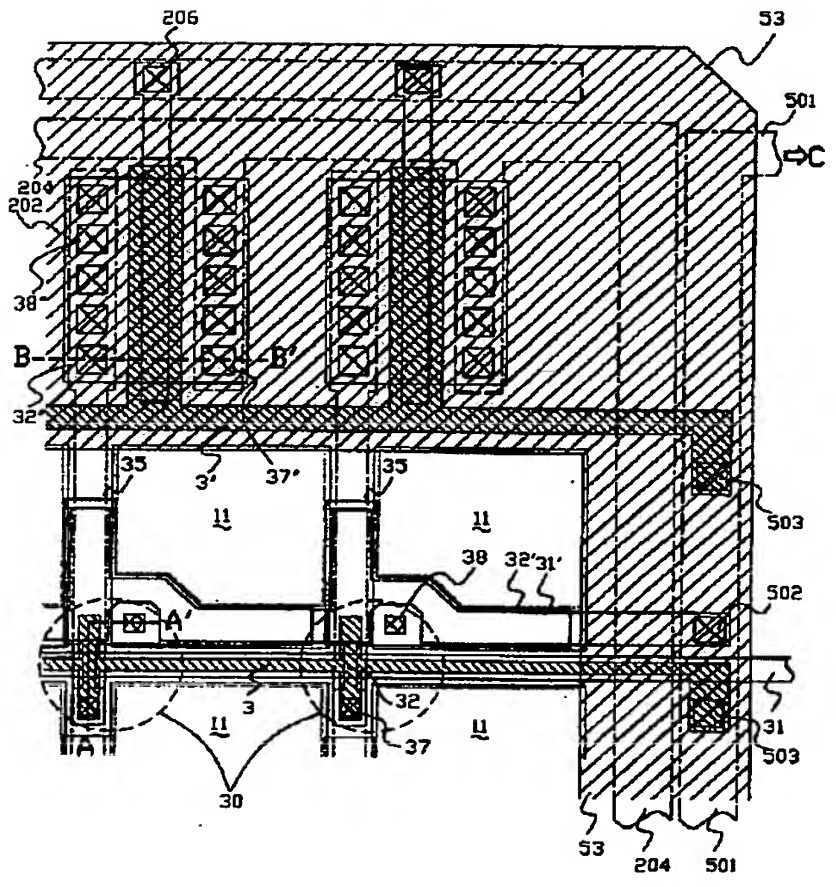
【図９】


401
検査回路
403b
403a
TX2
TX1
402
404a
404b
CX1
CX2
CX3
CX4
404c
404d
35

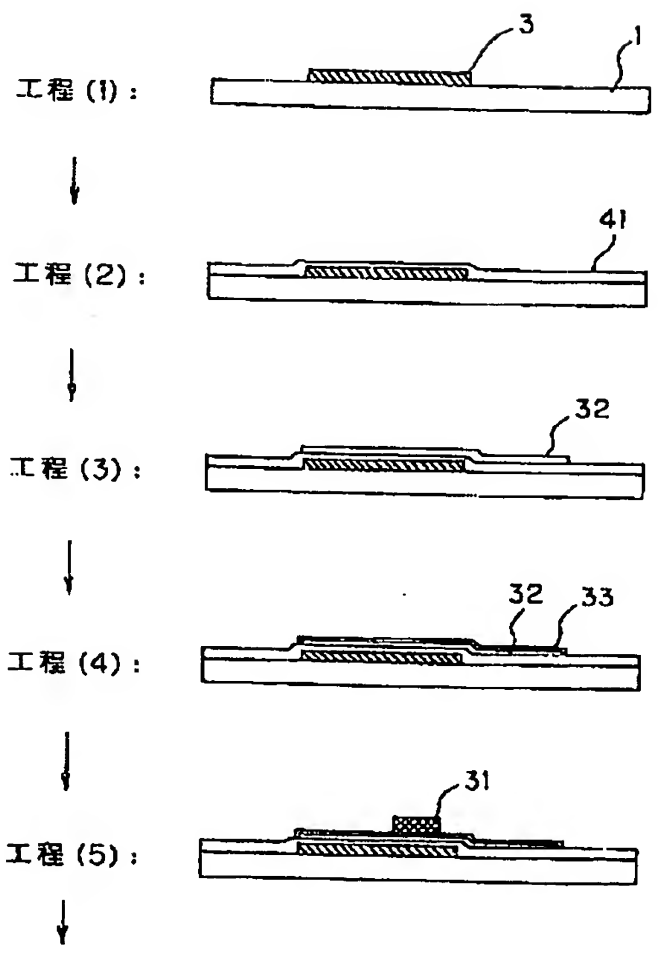
【図６】


入射光
10
53：周辺見切り
B'
B
A
A'
23
2
21
22
37"
38"
37
38
50
12
11
43
42
41
1
204
34"
206
3"
32"
33"
36"
35
34
31
3
32
33
36
32'
31'
33'
202：TFT
(プリチャージ回路)
戻り光
30:TFT
70:蓄積容量

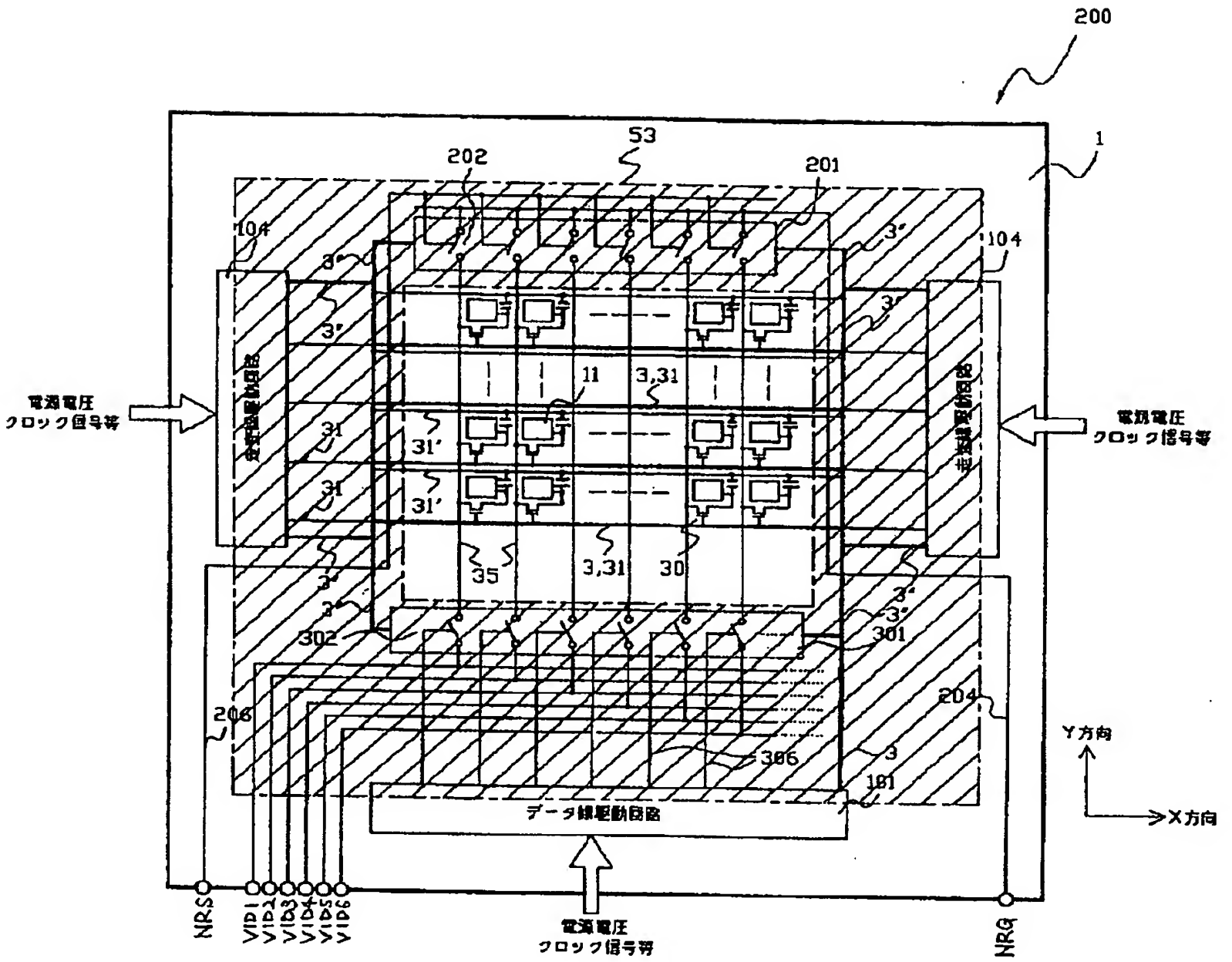
【図７】


206
53
501
⇨C
204
202
38
B
B'
32
35
3'
37'
11
503
38
32'
31'
502
A
A'
3
32
37
31
30
53
204
501

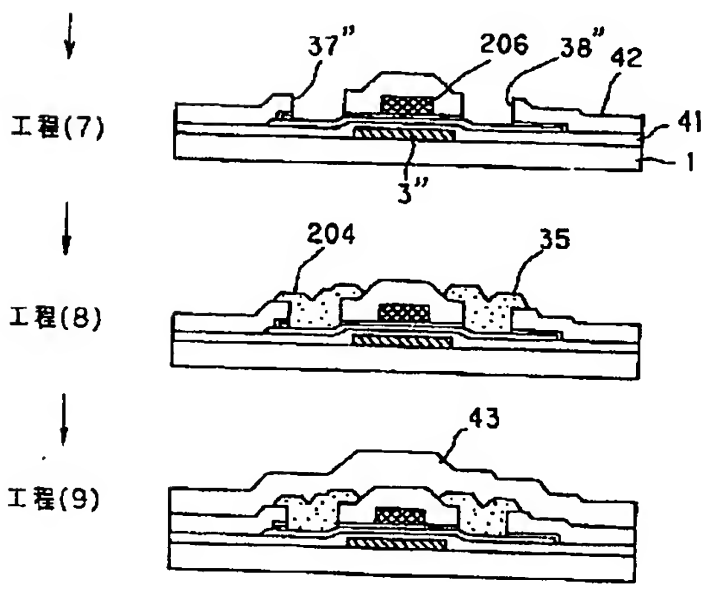
【図１０】


工程 (1)：
3
1
工程 (2)：
41
工程 (3)：
32
工程 (4)：
32
33
工程 (5)：
31

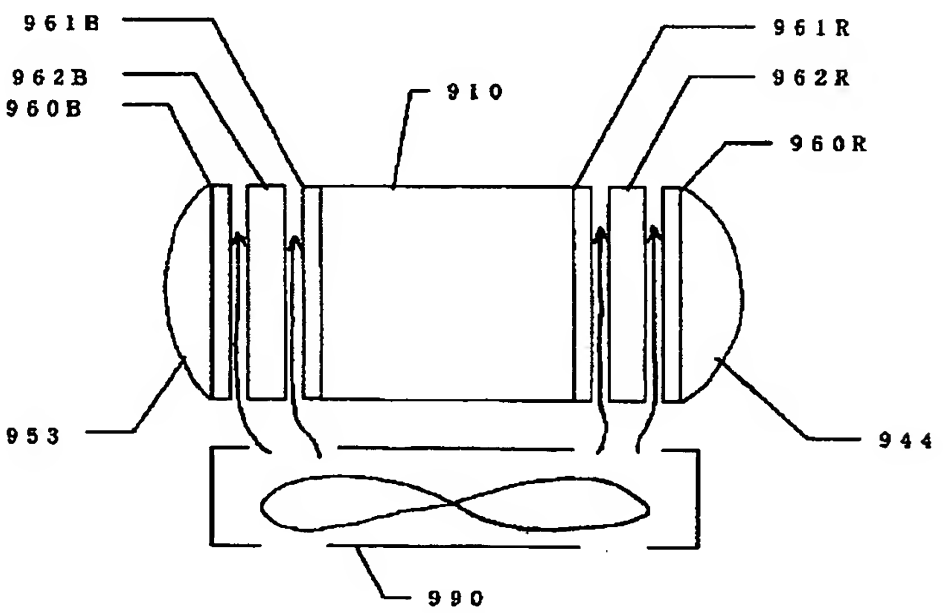
【図８】


200
1
53
202
201
104
104
3"
11
3,31
31
31'
35
30
302
301
204
206
306
101
データ線駆動回路
走査線駆動回路
走査線駆動回路
電源電圧
クロック信号等
電源電圧
クロック信号等
Y方向
X方向
NRS
VID1
VID2
VID3
VID4
VID5
VID6
電源電圧
クロック信号等
NRG

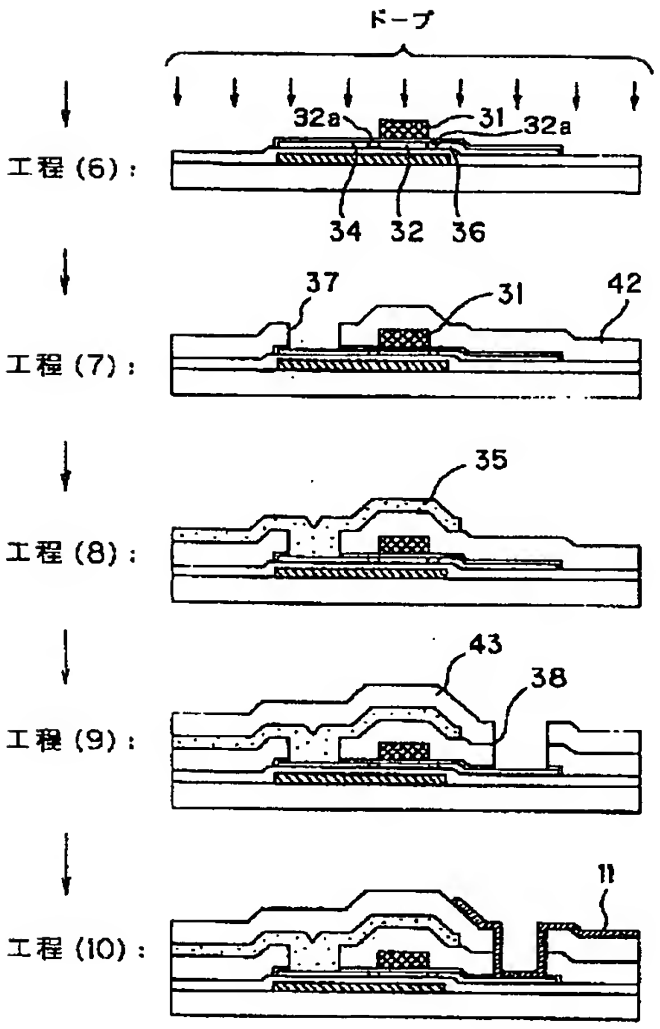
【図１２】


工程(7)
37"
206
38"
42
41
1
3"
工程(8)
204
35
工程(9)
43

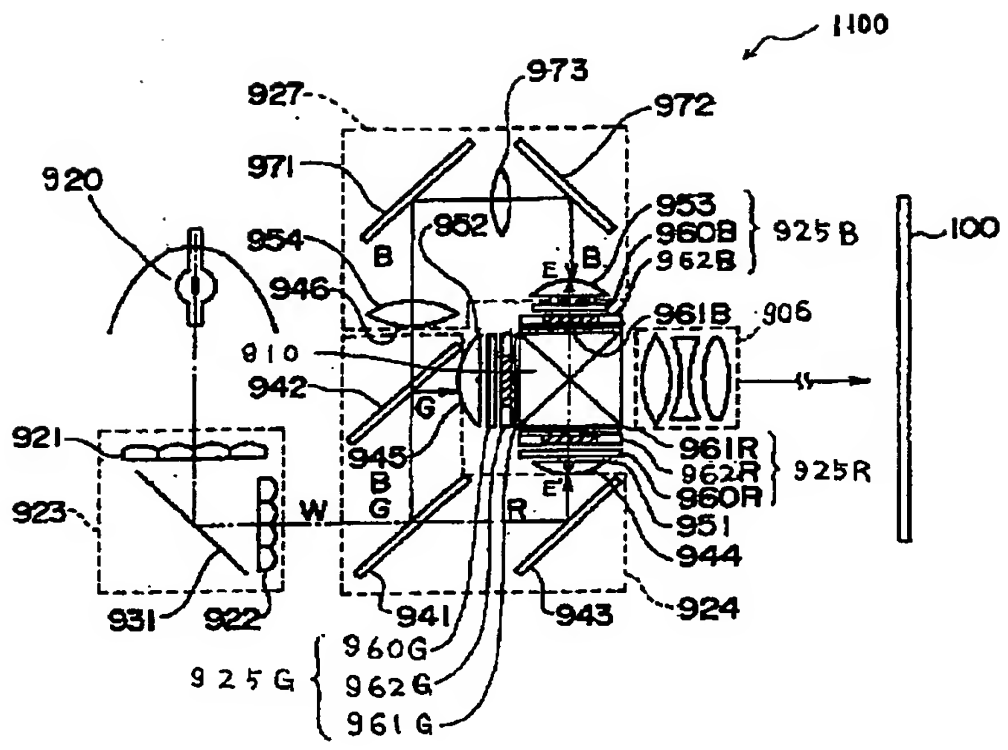
【図１５】


961B
962B
960B
910
961R
962R
960R
953
944
990

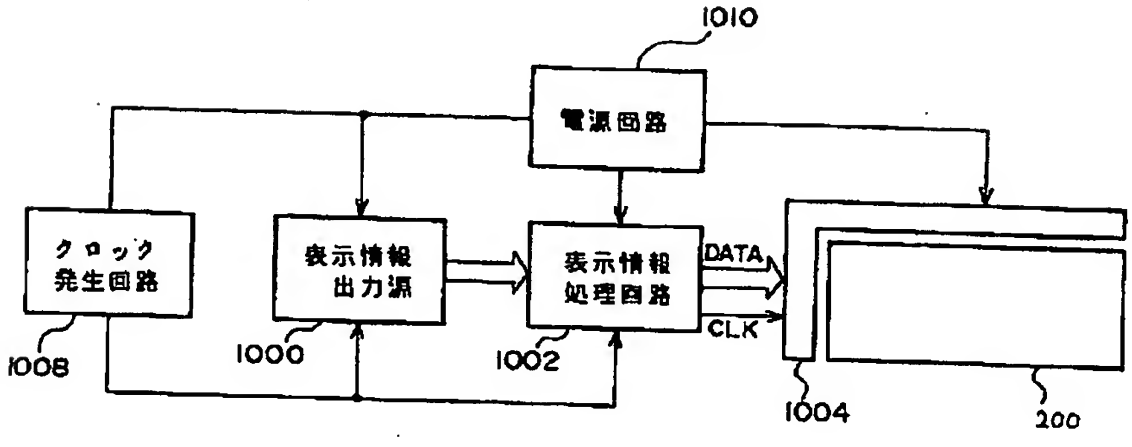
【図１１】


ドープ
工程(6)：
32a
31
32a
34
32
36
工程(7)：
37
31
42
工程(8)：
35
工程(9)：
43
38
工程(10)：
11

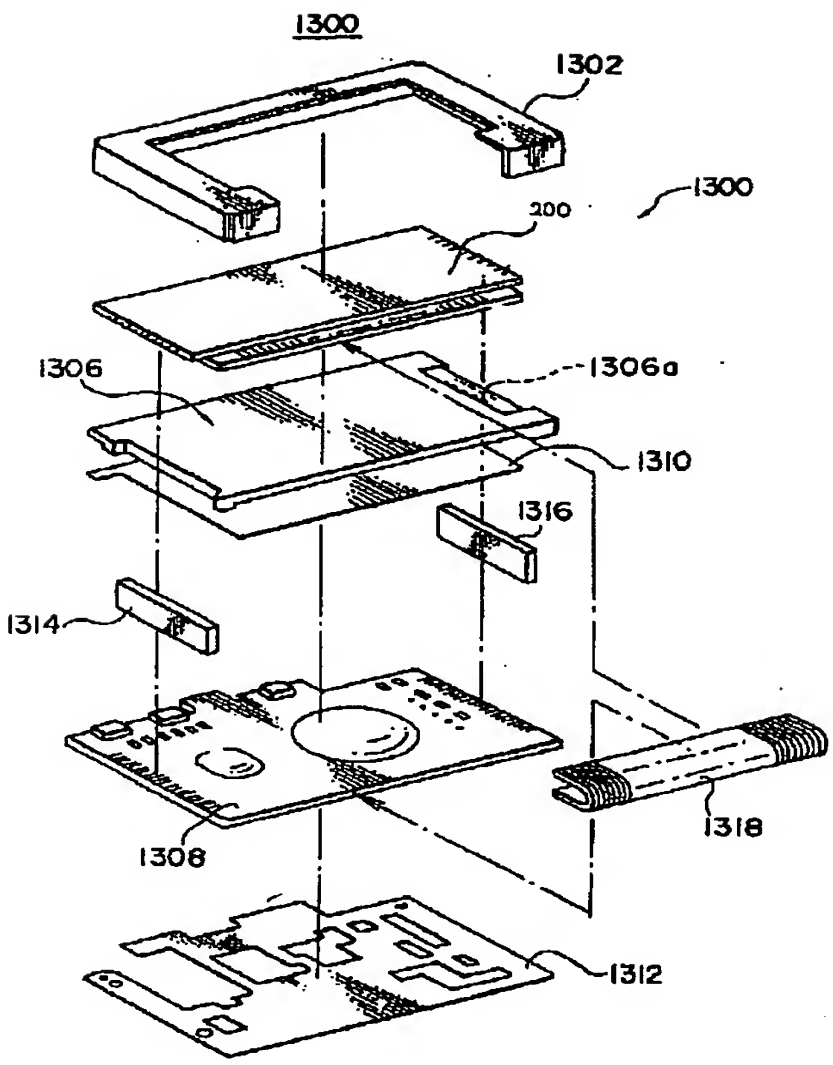
【図１４】


1100
927
973
972
971
920
953
960B
962B
925B
100
954
952
B
946
961B
906
910
942
G
921
945
961R
962R
960R
925R
923
W
951
944
931
922
941
943
924
925G
960G
962G
961G

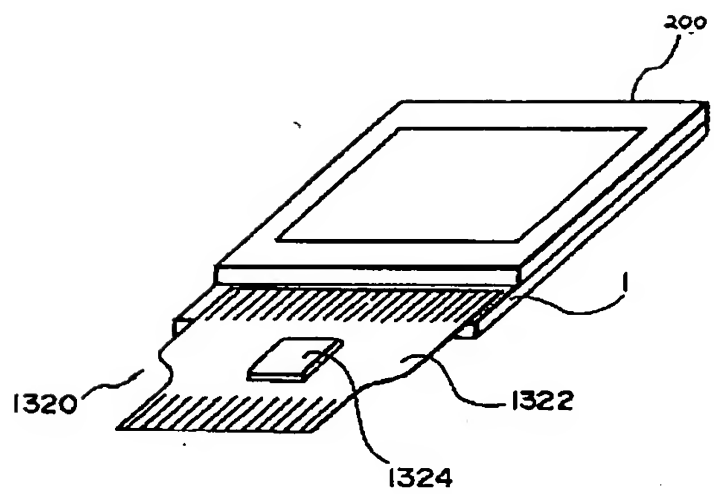
【図１３】


1010
電源回路
クロック
発生回路
表示情報
出力源
表示情報
処理回路
DATA
CLK
1008
1000
1002
1004
200

【図１７】


1300
1302
1300
200
1306
1306a
1310
1316
1314
1318
1308
1312

【図１８】


200
1
1320
1322
1324